# Contents


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| **Features and benefits** | 4 |


## Proportional valves


| Type | Basic model | ISO 4401 size | Rated flow range l/min (USgpm) | Max. operating pressure bar (psi) | Typical hysteresis % | Typical 0-100% step response ms | |
|---|---|---|---|---|---|---|---|
| Directional control, without feedback transducer | KDG4V-3 | 03 | 3 – 28 (0.8 – 7.4) | 350 (5075) | <8 | 32 | 6 |
| | KDG4V-5 | 05 ◪ | 30 – 65 (7.8 – 17.1) | 315 (4567) | <8 | 75 | |
| Throttle, without feedback transducer | KTG4V-3 | 03 | 3 – 20 (0.8 – 5.3) | 350 (5075) | <8 | 32 | 14 |
| | KTG4V-5 | 05 ◪ | 30 – 50 (7.8 – 13.2) | 315 (4567) | <8 | 75 | |
| Directional control with feedback transducer | KFDG4V-3 | 03 ◪ | 7 – 28 (1.9 – 7.4) | 350 (5075) | <1 | 18 | 20 |
| | KFDG4V-5 | 05 ◪ | 50 – 70 (13.2 –18.5) | 315 (4567) | <1 | 31 | |
| Throttle, with feedback transducer | KFTG4V-3 | 03 ◪ | 7 – 20 (1.9 – 5.3) | 350 (5075) | <1 | 18 | 24 |
| | KFTG4V-5 | 05 ◪ | 50 – 70 (13.2 – 18.5) | 315 (4567) | <1 | 31 | |
| Directional control, for closed-loop, position controlled applications | KSDG4V-3 | 03, plus drain port | 7 – 28 (1.9 – 7.4) | 350 (5075) | <0,5 | <10 | 28 |
| Directional control, with feedback transducer | KFDG5V-5 | 05▲ | 80 – 100 (21 – 26) | 315 (4567) | <2 | 30 | 32 |
| | KFDG5V-7 | 07 | 160 – 200 (42 – 52) | 350 (5075) | <2 | 50 | |
| | KFDG5V-8 | 08 | 270 – 300 (71 – 79) | 350 (5075) | <2 | 67 | |
| Directional control, with pilot and main-stage feedback transducers | KHDG5V-5 | 05▲ | 80 – 100 (21 – 26) | 315 (4567) | <1 | 24 | 32 |
| | KHDG5V-7 | 07 | 160 – 200 (42 – 52) | 350 (5075) | <1 | 24 | |
| | KHDG5V-8 | 08 | 270 – 300 (71 – 79) | 350 (5075) | <1 | 37 | |


## Supporting products

Products are cross-referenced in the proportional valve pages


| | |
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| Hydrostat and pilot shuttle modules | 39 |
| Mounting surfaces, subplates, parallel-flow-path modules ■ and fasteners for: | |
| Size 03 valves | 43 |
| Size 05 valves | 45 |
| Size 07 valves | 49 |
| Size 08 valves | 52 |

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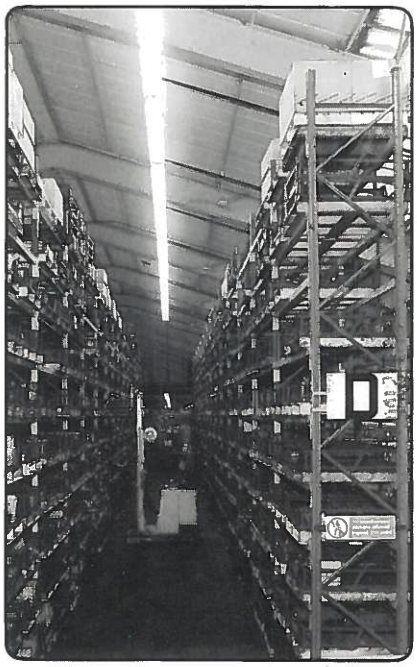

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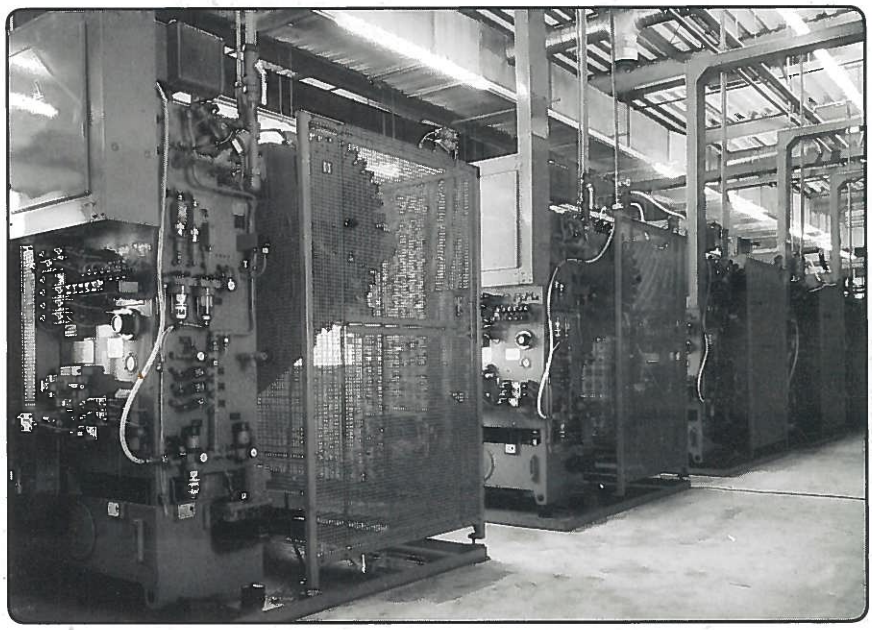

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# Proportional Valves

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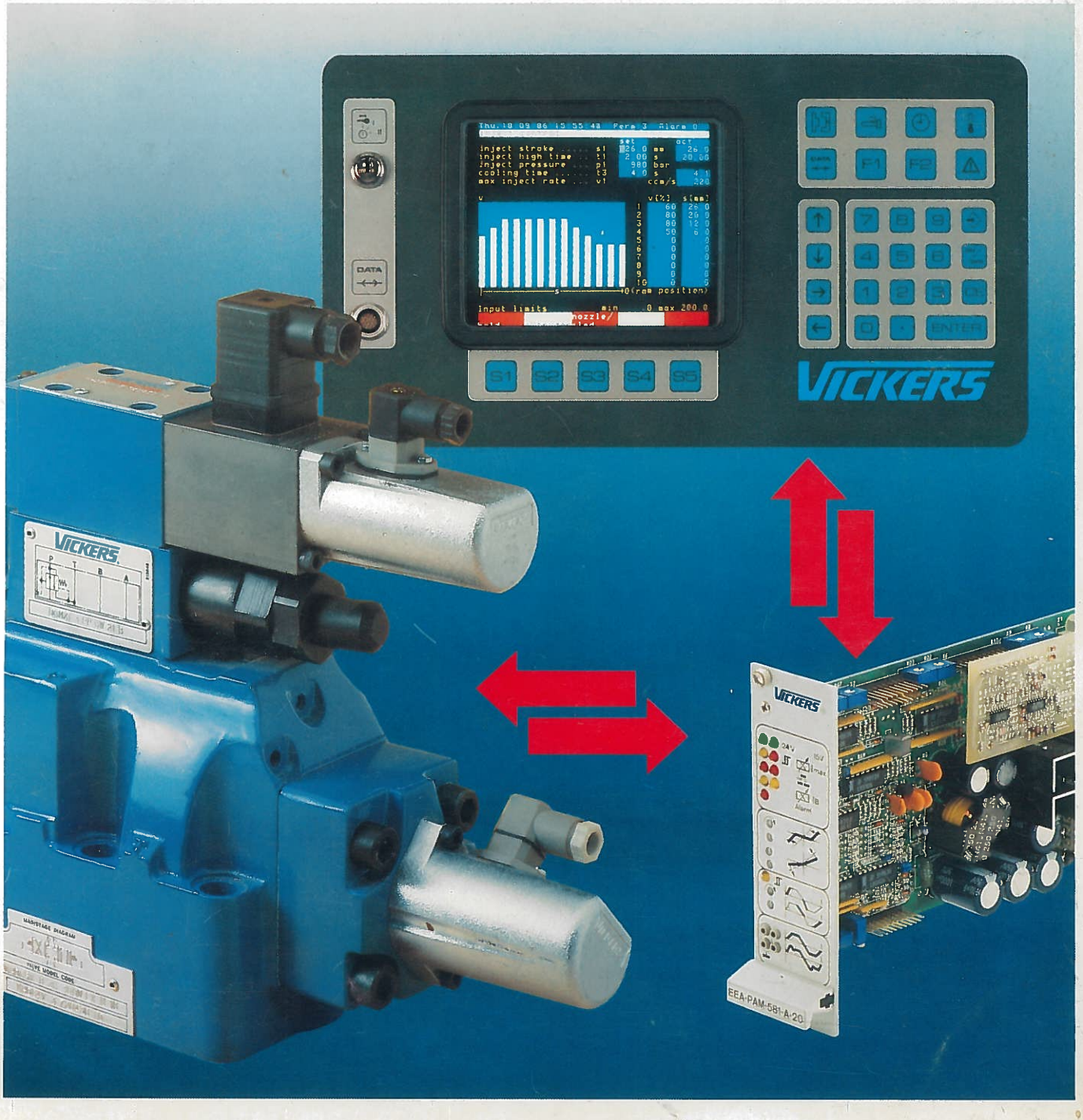

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## Supporting products, continued

Power amplifiers, basic models

Eurocard type:
EEA-PAM-523/525-A-30 series for K*G4V-3/5 --- H non-feedback valves 55
EEA-PAM-533/535-A-30 series for KF*G4V-3/5 valves 59
EEA-PAM-553-A-30 series for KSDG4V-3 valves 63
EEA-PAM-561-A-30 series for KFDG5V-5/7 valves 67
EEA-PAM-568-A-30 series for KFDG5V-8 valves 67
EEA-PAM-581-A-30 series for KHDG5V-5/7/8 valves 71

ISO 4400 (DIN 43650) power-plug type:
EHH-AMP-702-D/E-10 series for K*G4V-3/5 --- H valves 75

Power amplifiers, special purpose models

Eurocard type:
EEA-PAM-5**-B-30 series, with command logic module and 2 ramps 79
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EEA-PAM-5**-E-30 series, with strip-guidance-controller module 92
EEA-PAM-5**-F-30 series, with CNC-adaptation module 96

ISO 4400 (DIN 43650) power-plug type:
EHH-AMP-702-C/F-10 series, "soft switch" version, for K*G4V-3/5 ---H valves 101

Power supply units:
EHA-PSU-703, 24V DC x 20A 105
EHA-PSU-704, 24V DC x 3,5A 108

Portable test equipment 111

Electronic accessories 114

## Further information

Page

Hydraulic fluids, temperature ranges, filtration recommendations and contaminant control 115
Installation and commissioning (start-up) 117
Spare parts 117
Repair and warranty 117

## Valve selection guidelines 118

◪ Plus drain port for optional use ▲ Plus pilot pressure and drain ports
■ For size 03 and 05 valves only

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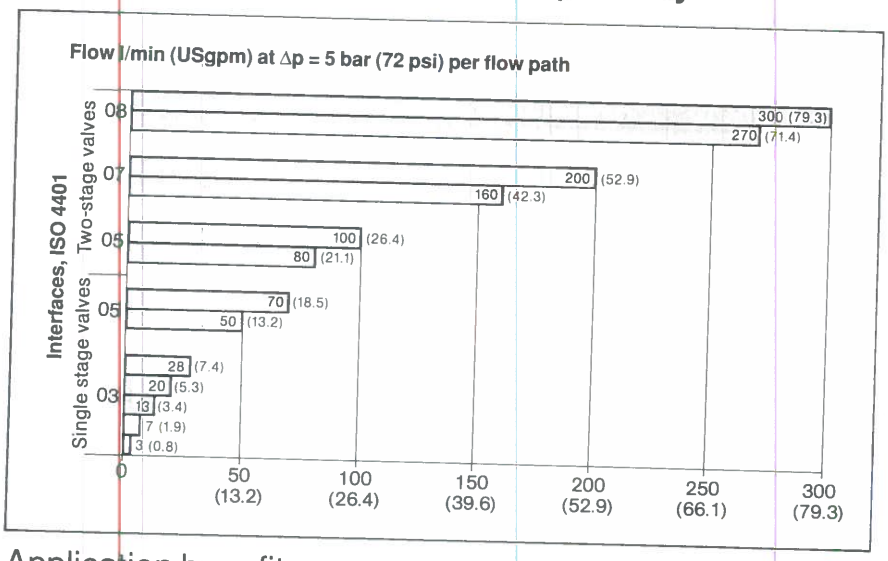
# Proportional valves and amplifiers with 7 impressive features

## 1. Wide range of flow capability

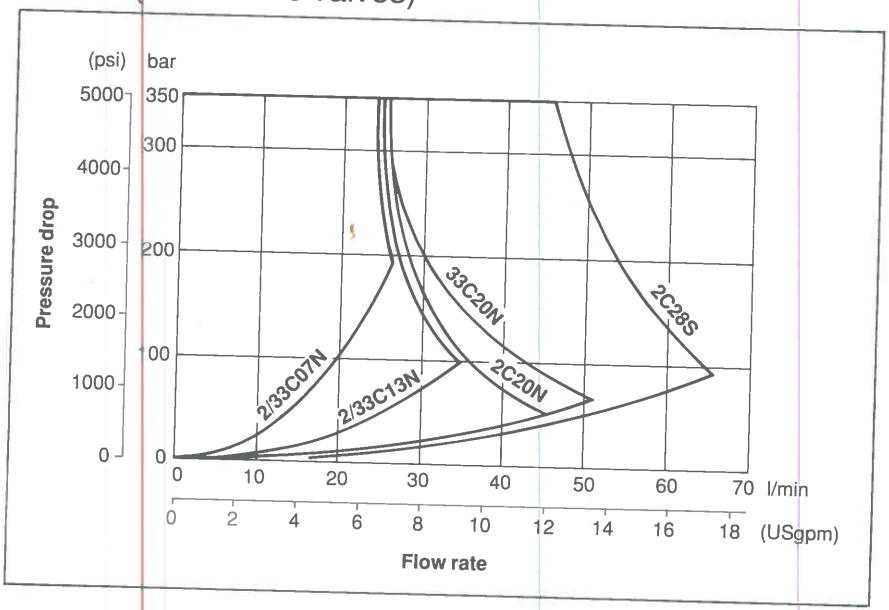



Application benefit

- Wide range of sizes allows selection of valve best suited to the application.

## 2. Wide range of spool ratings

Typical power envelopes for seven spool types (KFDG4V-3 valves)

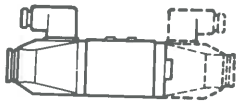



Application benefit

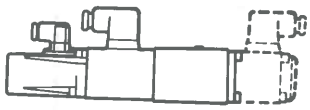
- Optimized system performance within a selected valve size.

## 3. Performance choices to match requirements

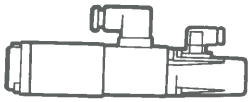
**Directional and throttle valves**
KD/TG4V-3/5 without feedback transducer.
Hysteresis <8%



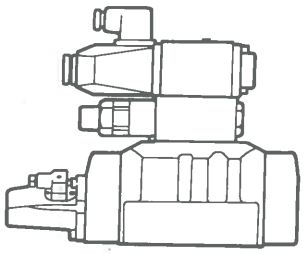
KFD/TG4V-3/5 with feedback transducer.
Hysteresis <1%



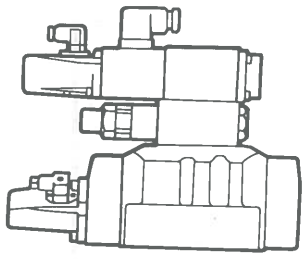
**Directional valves**
KSDG4V-3 with feedback transducer.
Hysteresis <0.5%



KFDG5V-5/7/8 with main-stage feedback transducer.
Hysteresis <2%



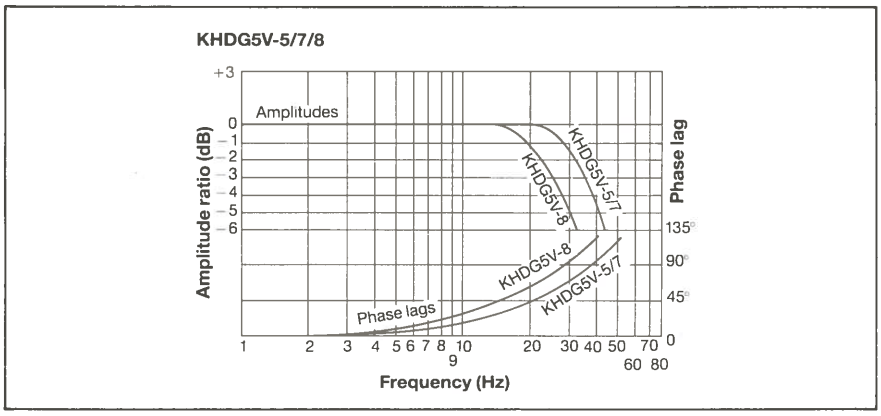
KHDG5V-5/7/8 with main-stage and pilot-stage feedback transducers.
Hysteresis <1%



Application benefits

- Outstandingly low hysteresis without external closed-loop circuitry
- KSDG4V-3 models designed for position-controlled closed-loop applications.

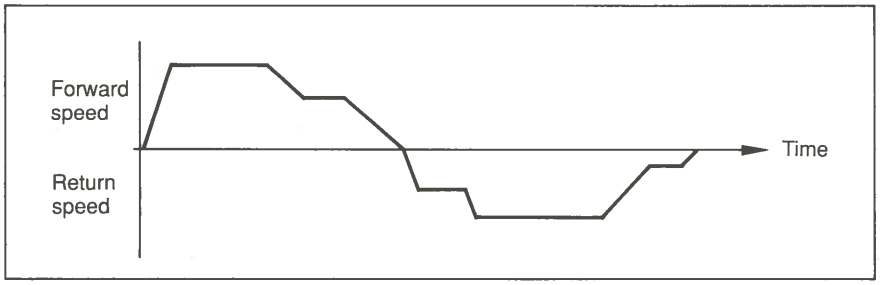
# 4. Fast and precise motion control
(Typical for KHDG5V models)




## Application benefits

- High dynamic performance
- Suitable for both open and closed loop applications
- Improved response for greater motion and cycle accuracy
- Shorter cycle times.

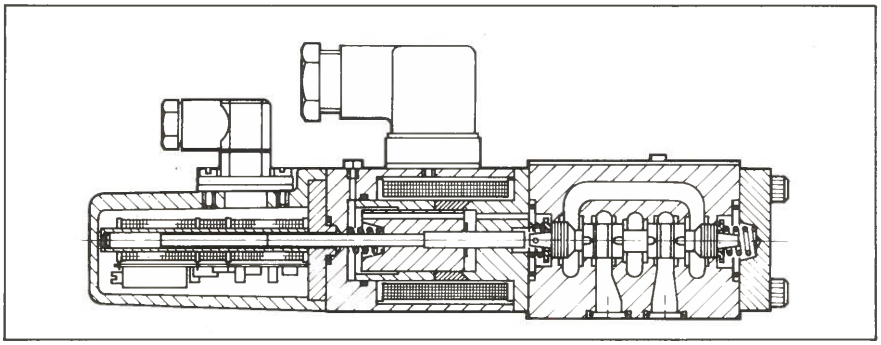
# 5. Stepless ramp adjustment for on-site pre-setting
Typical cycle




## Application benefits

- Fast, shockless operating cycles
- Optimum matching to application requirements
- Independent or common adjustment of acceleration and deceleration.

# 6. Position feedback for fast and precise spool positioning

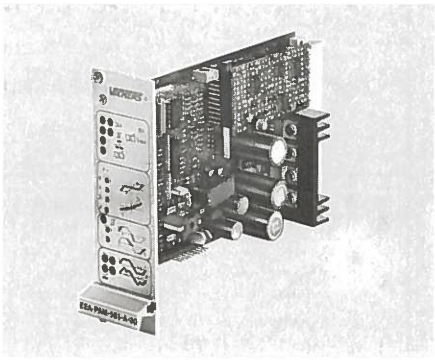


## Application benefits

- Electronic feedback ensures accurate speed control
- Wire-break detection circuitry isolates solenoid drive(s)
- Current feedback provides inherent protection from electrical interference.

# 7. Optimum valve performance from Vickers power amplifiers

## IEC 297 (Eurocard) mounting



## Application benefits

- Six command input pin options for easy matching to control system
- Easily identifiable adjustment features
- Straightforward system trouble-shooting with function-monitoring LEDs and test points
- Optional integration in either a 19" rack or a card-holder
- Choose from up to six versions of each amplifier to suit individual applications.

## ISO 4400 plug mounting

## Application benefits

- Low cost
- Adjustable gain, ramps and deadband compensation
- Ease of installation at reduced cost
- Proportional and "soft switch" options available.

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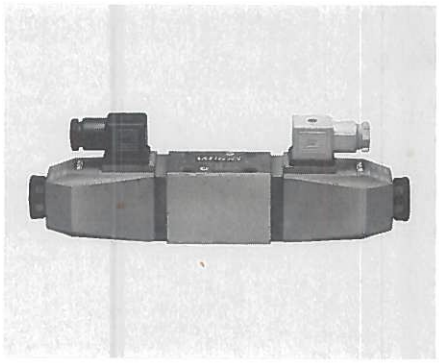
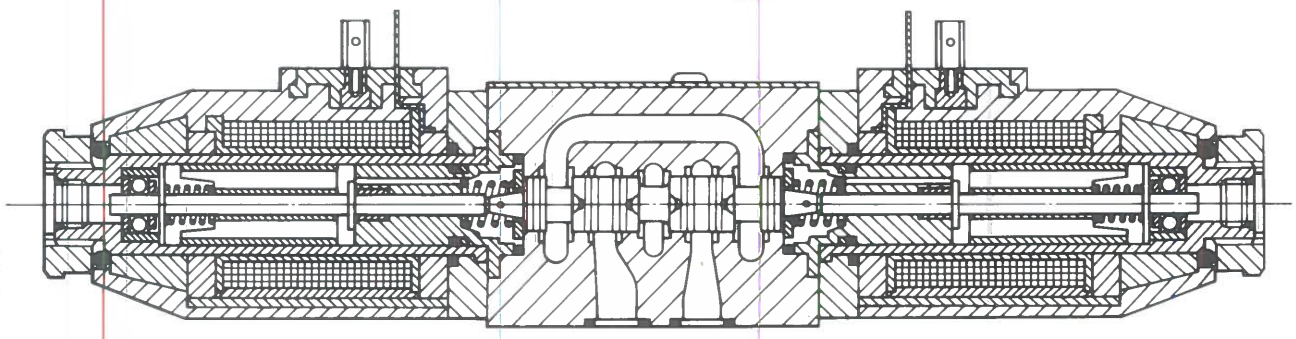
# Proportional directional control valves, single-stage design, without integral feedback transducers

KDG4V-3, 20 series
KDG4V-5, 30 series

ISO 4401 sizes 03 and 05

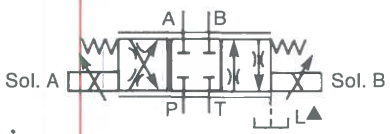


**1. Typical section KDG4V-3 example**

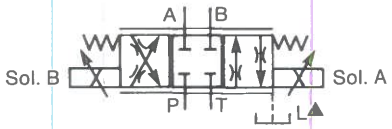


**2. Functional symbols and applications**

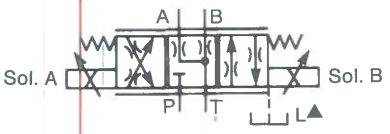
KDG4V-*-2C**N-*-VM



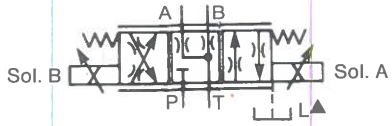

KDG4V-*-2C**N-*-M



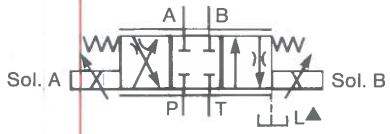

KDG4V-*-33C**N-*-VM



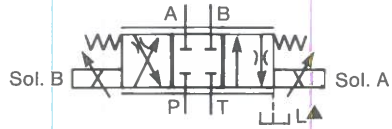

KDG4V-*-33C**N-*-M




KDG4V-*-2C**S-*-VM




KDG4V-*-2C**S-*-M




▲ Drain port L is in KDG4V-5 models only

## Application notes

**A. Flow characteristics**
KDG4V valves are designed to throttle flow in proportion to command signals and are dependent on valve pressure drop. However, they have an inherent degree of load compensation whereby increasing valve pressure drop has progressively less effect on flow rate. Load compensation can also be achieved electronically or by external hydraulic means. Your Vickers representative can advise on an arrangement to suit your application, a possible hydraulic solution being a hydrostat installed under the valve; see "Hydrostat and . . ." in "Contents" pages.

**B. Position-controlled closed-loop applications**
Take account of the possible effects that the blocked port conditions may have on system performance.

## 3. Model codes

**For proportional valves**

**KDG4V-*-**C***-*-(V)M-U-**-**

1 2 3 4 5 6 7 8

1 **Mounting size code (ISO 4401)**
3 = 03
5 = 05

2 **Spool type**
2 or 33; see "Functional symbols"

3 **Flow rating**
Looped flow path P-A-B-T or P-B-A-T. △p = 5 bar (72 psi) per metering path e.g. P-A or B-T.

For KDG4V-**3** valves:
03F = 3 l/min (0.8 USgpm)
07N = 7 l/min (1.8 USgpm)
13N = 13 l/min (3.4 USgpm)
20N = 20 l/min (5.3 USgpm)
28S = 28 l/min (7.4 USgpm) ■

For KDG4V-**5** valves:
30N = 30 l/min (7.8 USgpm)
50N = 50 l/min (13.2 USgpm)
65S = 65 l/min (17.1 USgpm) ■

■ Type 2 spools only

4 **Manual overrides**
H = Water-resistant. Option for KDG4V-3 only
Z = No overrides

5 **Solenoid energization identity**
V = Solenoids A and B at port A and B ends respectively (German practice).
Blank = Solenoid A energized selects P to A and solenoid B energized selects P to B (US ANSI B93.9 standard).

6 **Coil rating code**
Relates to current and resistance ratings in "Operating data" table below:
G = Option requiring customer-supplied amplifier
H = Option requiring an appropriate amplifier; see "Contents" pages.

7 **Port T limit code** ▲
6 = For KDG4V-5-**C65S
7 = For all other models

▲ See "Max. pressures" table on next page.

8 **Design number**
20 series for KDG4V-3 valves
30 series for KDG4V-5 valves
Subject to change. Installation dimensions unaltered for design numbers *0 to *9 inclusive.

**Solenoid plugs**
To be ordered separately; see six pages on.

For supporting products
(see "Contents" pages)
- Power amplifier options
- Power supply unit options for KDG4V----H valves
- Electronic accessories
- Pressure hydrostat options
- Mounting surface dimensions, subplate, and bolt kit options
- Portable test equipment

## 4. Operating data

Performance data is typical with fluid @ 36 cSt (166 SUS) and 50° C (122° F) while using the basic Vickers power amplifier.

| | |
|---|---|
| Max. pressures | See table on next page |
| Flow rating | See 3 in "Model codes" section 3 |
| Max. current, @ 50° C (122° F) ambient: | |
| "G"-coil valves | 3,5 A |
| "H"-coil valves | 1,6 A |
| Coil resistance, @ 20° C (68° F): | |
| KDG4V-3 . . . . . G7 | 1,45 Ω |
| KDG4V-3 . . . . . H7 | 7,0 Ω |
| KDG4V-5 . . . . . G* | 1,68 Ω |
| KDG4V-5 . . . . . H* | 7,7 Ω |
| Coil inductance, @ 1000 Hz & 150 mV: | |
| KDG4V-3 . . . . . G7 | 4 mH |
| KDG4V-3 . . . . . H7 | 20 mH |
| KDG4V-5 . . . . . G* | 8 mH |
| KDG4V-5 . . . . . H* | 38 mH |
| Relative duty factor | Continuous rating E D = 100% |
| Type of protection, with electrical plugs fitted correctly | IEC 144 Class IP65 |
| Power capacity envelopes | See graphs on next page |
| Flow gain | See graphs commencing two pages on |
| Hysteresis, with flow thru P-A-B-T. △p = 5 bar (72 psi) per metering path eg. P-A | < 8% of rated flow |
| Step input response, @ △p = 5 bar (72 psi) per metering path | Time to reach 90% of reqd. step: |
| Required flow step: | |
| KDG4V-3: 0 to 100% | 32 ms (0.032 s) |
| KDG4V-3: 100% to 0 | 30 ms (0.030 s) |
| KDG4V-3: +90 to −90% | 50 ms (0.050 s) |
| KDG4V-5: 0 to 100% | 75 ms (0.075 s) |
| KDG4V-5: 100% to 0 | 50 ms (0.050 s) |
| KDG4V-5: +90 to −90% | 80 ms (0.080 s) |
| Frequency response | See graphs five pages on |
| Reproducibility, valve-to-valve | Optimized by adjustment of deadband compensation, gain and ramp potentiometers on associated Vickers amplifier |
| Hydraulic fluids, temperature ranges and filtration recommendations | See "Contents" pages |
| Installation dimensions | See six pages on |
| Mass: | |
| KDG4V-3 | 2,4 kg (5.3 lb) approx. |
| KDG4V-5 | 6,8 kg (15 lb) approx. |
| Installation and commissioning (start-up) | See "Contents" pages |

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## ● Max. pressures, bar (psi)

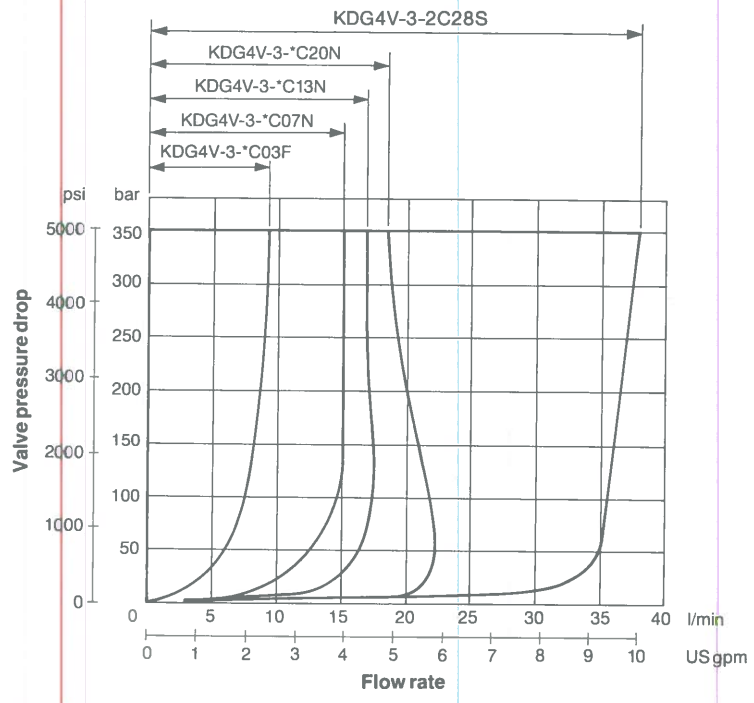
| Model | Port L condition ▲ | Ports P, A & B | T | L ▲ |
|---|---|---|---|---|
| All KDG4V-3 models | — | 350 (5075) | 210 (3000) | — |
| KDG4V-5-**C**N-*-(V)M-U-*7 models only | Externally drained | 315 (4567) | 210 (3000) | 10 (145) |
| All KDG4V-5 models | Blocked by mating surface | | 160 (2320) | 160 (2320) |

▲ If port T pressure will not exceed 160 bar (2320 psi), port L need not be connected to tank.

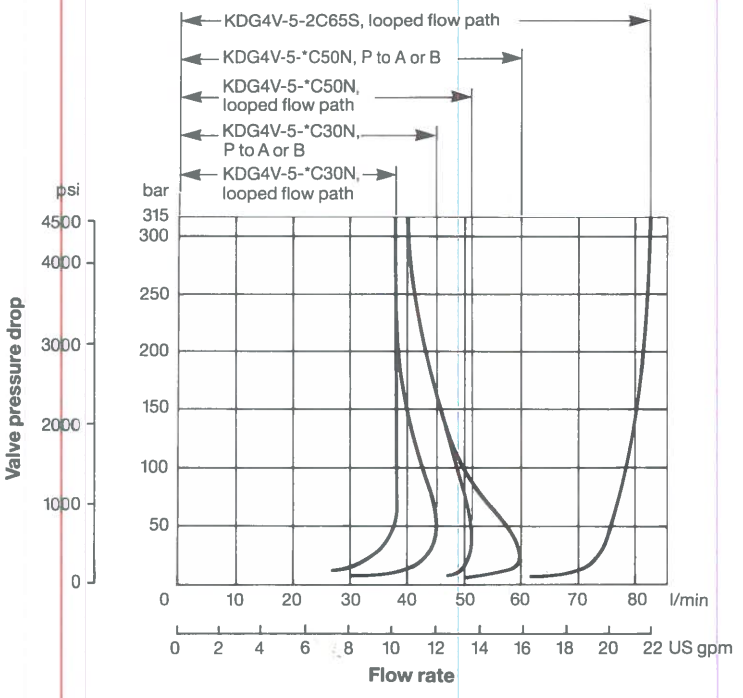
## ● Power capacity envelopes

Flow thru P-A-B-T or P-B-A-T, looped flow paths

### KDG4V-3 valves




### KDG4V-5 valves

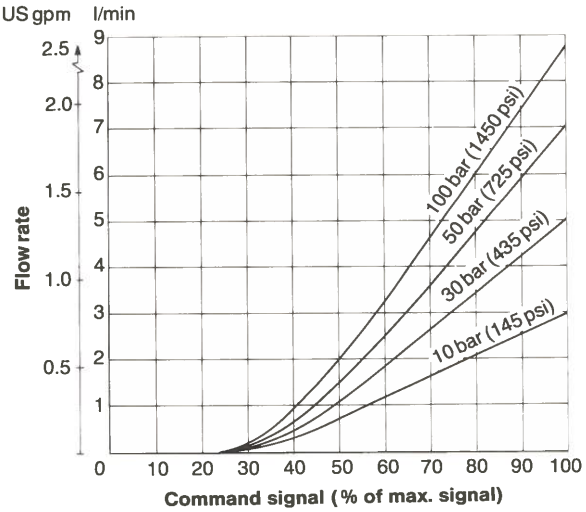


## ● Flow gain, KDG4V-3 valves

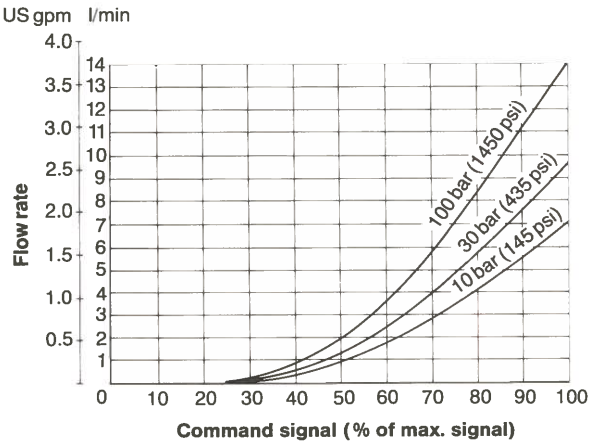
At stated valve pressure drops.
Percentage command signals applicable whichever solenoid is energized.

### Looped flow path
### P to A or B plus B or A to T

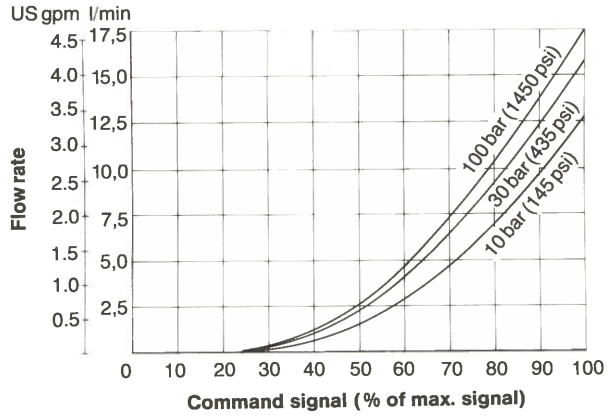
**KDG4V-3-2C03F**



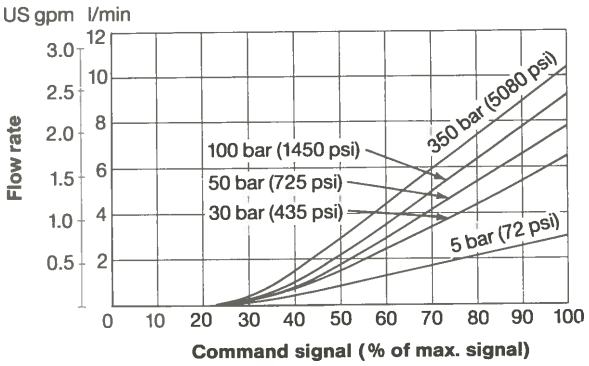

**KDG4V-3-2C07N**

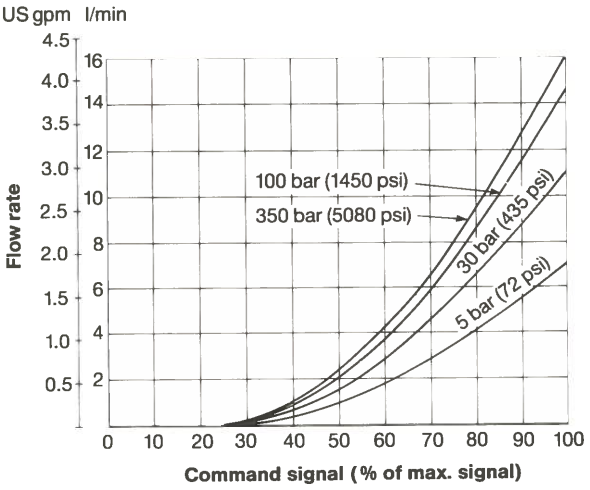


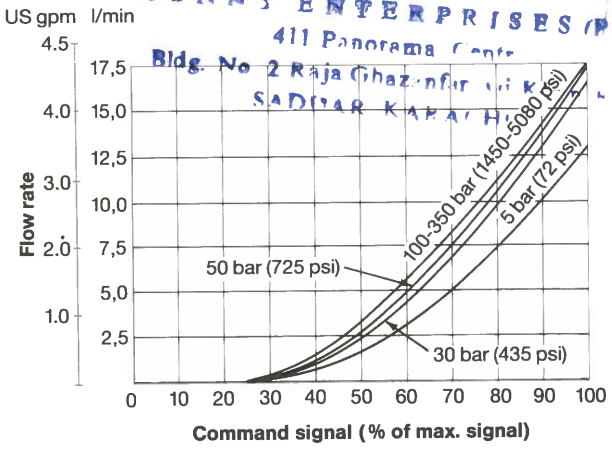

**KDG4V-3-2C13N**




### Single flow path
### P to A or B

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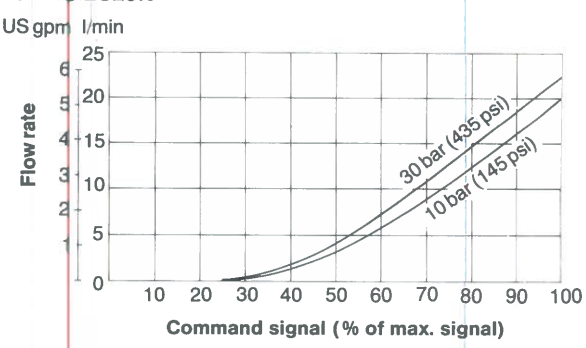
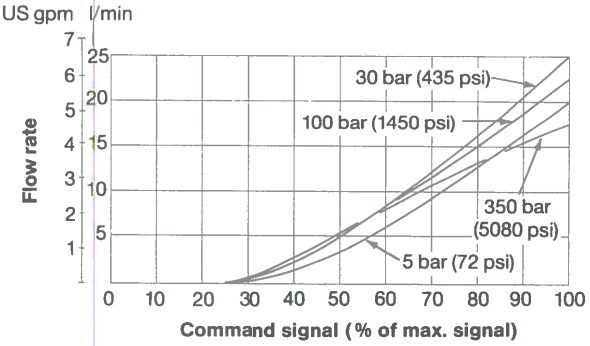
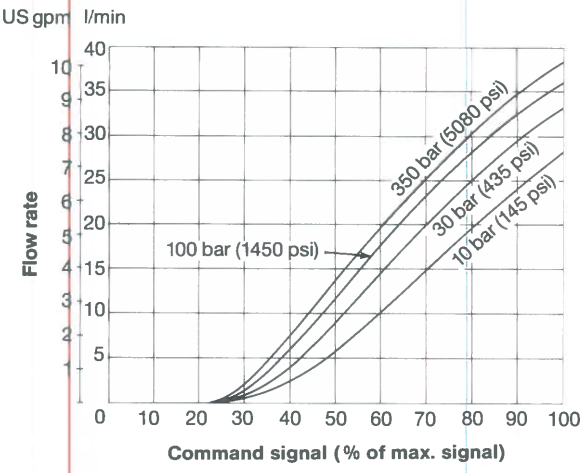
**KDG4V-3-2C20N**




**KDG4V-3-2C28S**

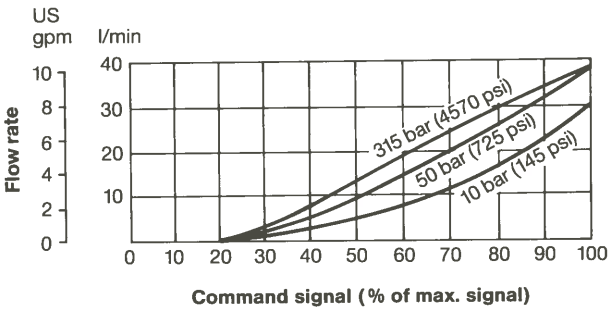


## ● Flow gain, KDG4V-5 valves

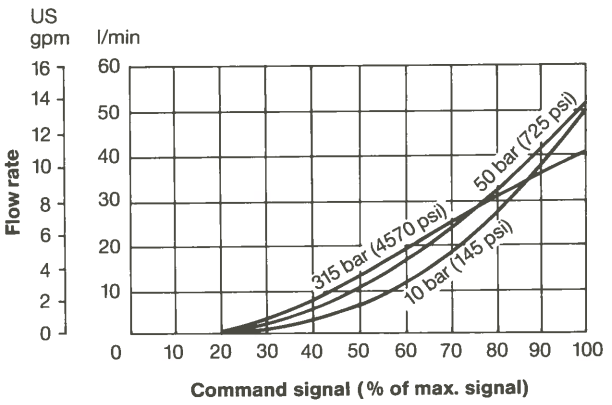
At stated valve pressure drops. Percentage command signals applicable whichever solenoid is energized

**Looped flow path**
**P to A or B plus B or A to T**

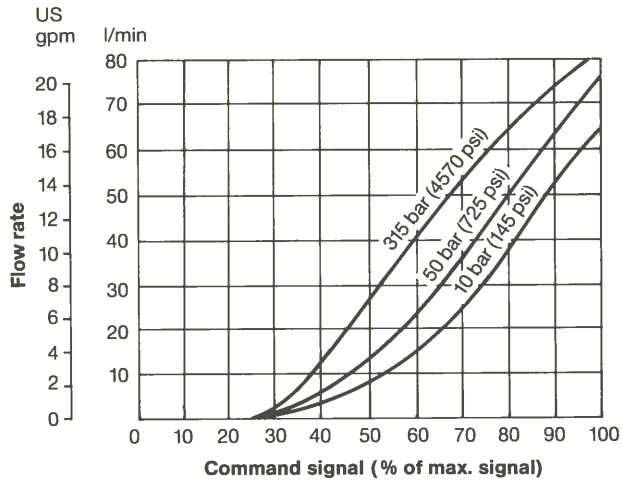
**KDG4V-5-*C30N**



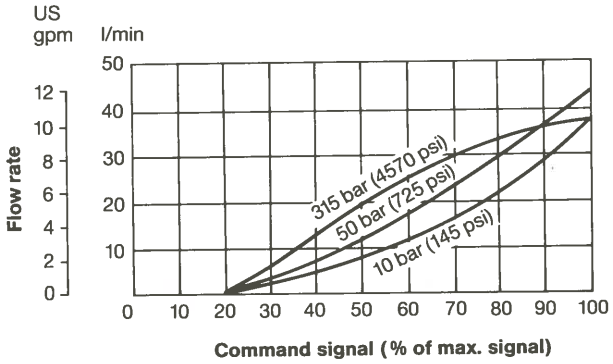

**KDG4V-5-*C50N**

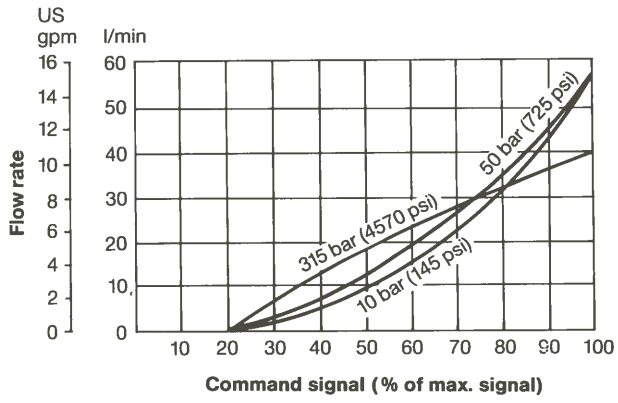



**KDG4V-5-2C65S**




**Single flow path**
**P to A or B**

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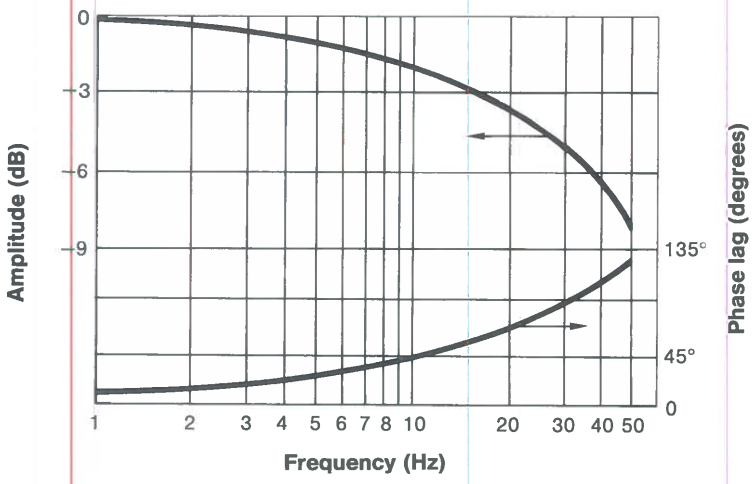
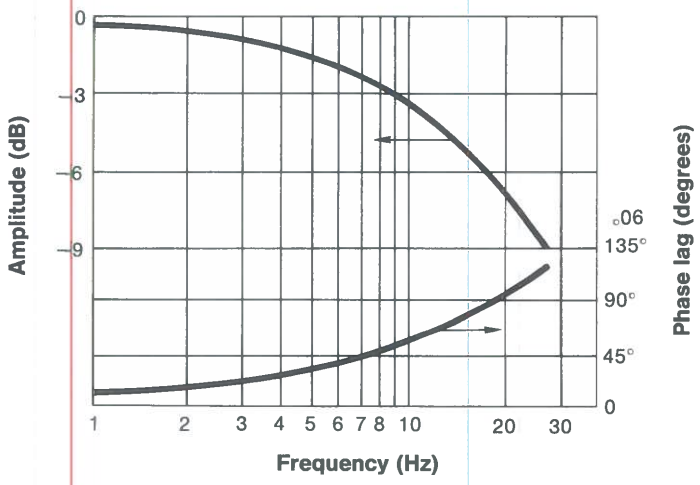
● **Frequency response**
For an amplitude of ±25% max. stroke (center-to-offset) about the 50% position and △p (P-A-B-T) = 10 bar (145 psi).

**KDG4V-3**



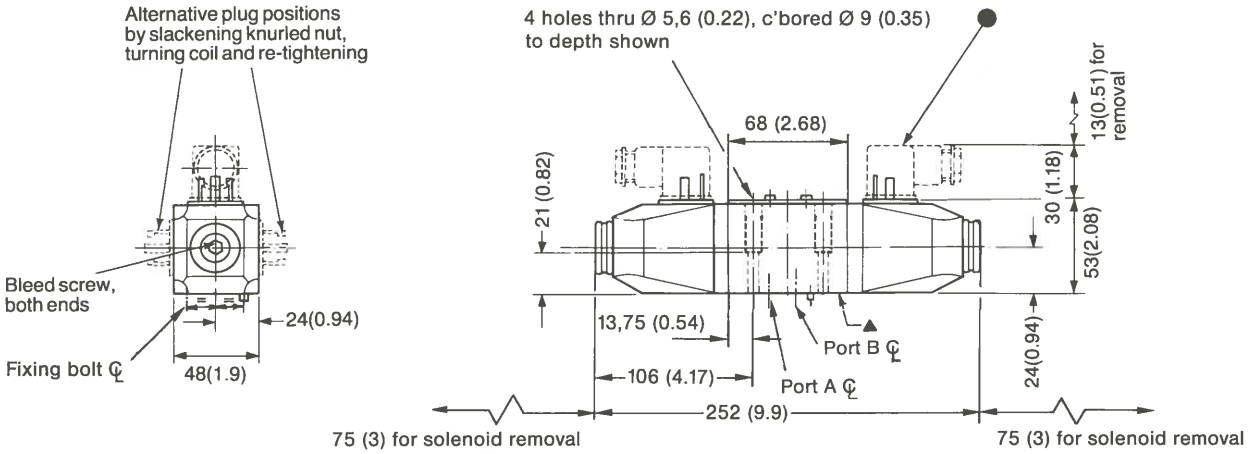

**KDG4V-5**



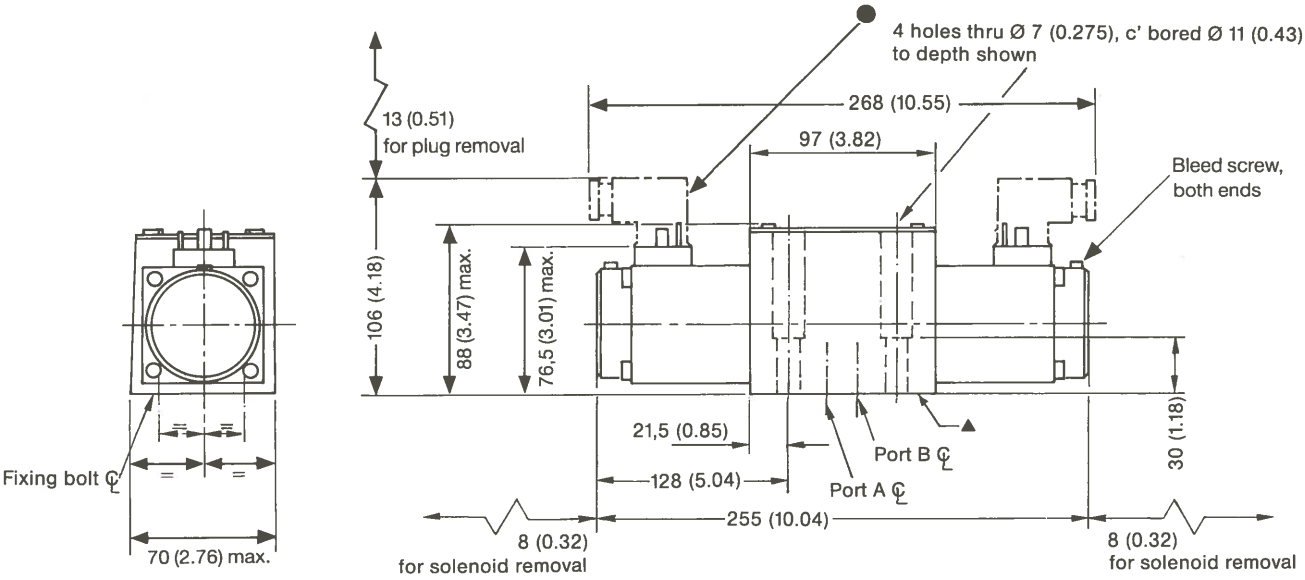
## 5. Installation dimensions in mm (inches)

3rd angle projection

### KDG4V-3 valves, without manual overrides




### KDG4V-5 valves




| ● Electrical plug connectors (without indicator light) to ISO 4400/DIN 43650. Must be separately ordered by part number(s). | | | |
|---|---|---|---|
| Part No | Color | Solenoid coil | Cable gland |
| 710775 | Black | Sol. B | Pg.11 |
| 710776 | Gray | Sol. A | Ø6-10(0.23-0.39 dia) |

Solenoid and plug identities

| At port 'A' end | At port 'B' end | For |
|---|---|---|
| A | B | KDG4V-*-*C***(-*)-VM |
| B | A | KDG4V-*-*C***(-*)-M |

The cable entry can be repositioned at 90° intervals from the position shown. This is done by re-assembling the contact holder into the appropriate position inside the plug connector housing.

▲ Mounting surface, seals supplied. For mating surface dimensions, subplate and bolt kit options, see "Contents" pages.

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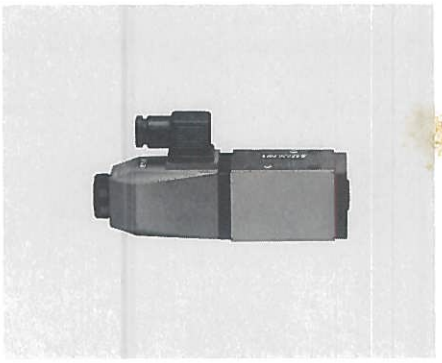
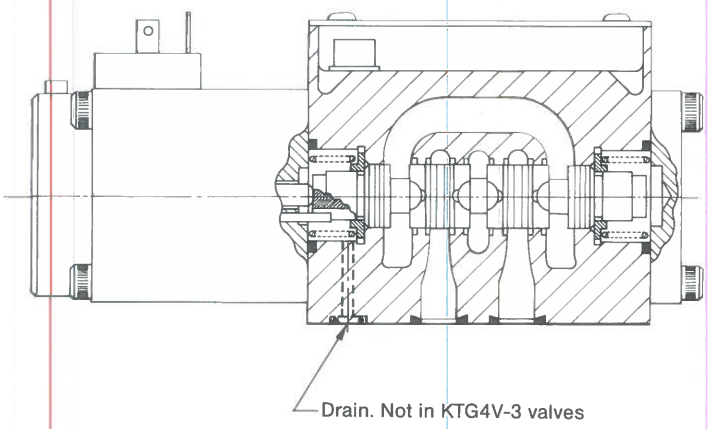
# Proportional throttle valves, without integral feedback transducers

KTG4V-3, 20 series
KTG4V-5, 30 series

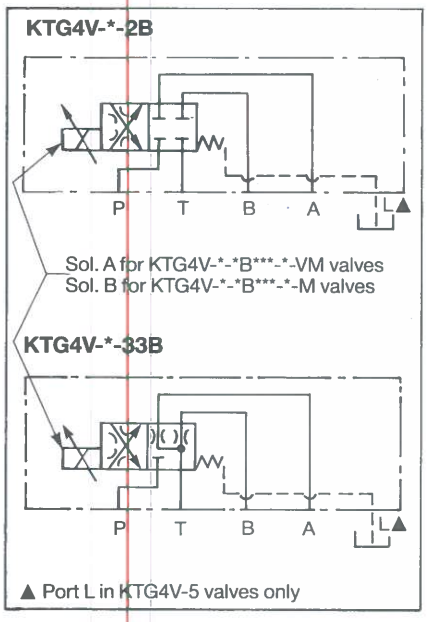
ISO 4401 sizes 03 and 05



## 1. Typical section, KTG4V-5 example




## 2. Functional symbols and applications




## Application notes

**A. Flow characteristics**
KTG4V valves are designed to throttle flow in proportion to command signals and are dependent on valve pressure drop. However, they have an inherent degree of load compensation whereby increasing valve pressure drop has progressively less effect on flow rate. Load compensation can also be achieved electronically or by external hydraulic means. Your Vickers representative can advise on an arrangement to suit your application, a possible hydraulic solution being a hydrostat installed under the valve; see "Hydrostat and . . ." in "Contents" pages.

**B. Rated flow boost**
Flow ratings (see 2 in "Model codes" section) are based on single-flow-path usage (P to B). Higher flow ratings can be attained by arranging the porting in the mounting block into a parallel-flow-path pattern. This will boost the valve's flow capacity considerably; see graphs commencing two pages on, plus "Mounting surface, . . ." in "Contents" pages.

**C. Position-controlled closed-loop applications**
Take account of the possible effects that the blocked port conditions may have on system performance.

## 3. Model codes

**For throttle valves**

**KTG4V- * -*B***- * -(V)M-U-* 7-****
1 2 3 4 5 6 7

1 **Mounting size code (ISO 4401)**
3 = 03
5 = 05

2 **Spool type**
2 or 33; see "Functional symbols" on this page.

3 **Flow rating**
Single-flow-path △p = 5 bar (72 psi)

For KTG4V-**3** valves:
03F = 3 l/min (0.8 USgpm)
07N = 7 l/min (1.8 USgpm)
13N = 13 l/min (3.4 USgpm)
20N = 20 l/min (5.3 USgpm)
28S = 28 l/min (7.4 USgpm), for type 2 spool only

For KTG4V-**5** valves:
30N = 30 l/min (7.8 USgpm)
50N = 50 l/min (13.2 USgpm)

4 **Manual override**
H = Water-resistant. Option for KTG4V-3 only
Z = No override

5 **Solenoid energization identity**
V = Solenoid A at port A end (German practice)
Blank = Solenoid B energized selects P to B (US ANSI B93.9 standard)

6 **Coil rating code**
Relates to current and resistance ratings in "Operating data" table on next page:
G = Option requiring customer-supplied amplifier
H = Option requiring appropriate amplifier; see "Contents" pages.

7 **Design number**
20 series for KTG4V-3 valves
30 series for KTG4V-5 valves
Subject to change. Installation dimensions unaltered for design numbers * 0 to * 9 inclusive.

**Solenoid plugs**
To be ordered separately; see five pages on.

For supporting products
(see "Contents" pages)

- Power amplifier options
- Power supply unit options for KTG4V----H valves
- Electronic accessories
- Pressure hydrostat options
- Mounting surface dimensions, subplate, parallel-flow path modules and bolt kit options
- Portable test equipment

## 4. Operating data

Performance data is typical with fluid @ 36 cSt (166 SUS) and 50° C (122° F) while using the basic Vickers power amplifier.

| | |
|---|---|
| Max. pressures | See table on next page |
| Flow rating | See [2] in "Model codes" on previous page |
| Max. current, @ 50° C (122° F) ambient:<br>"G"-coil valves<br>"H"-coil valves | <br>3,5 A<br>1,6 A |
| Coil resistance, @ 20° C (68° F):<br>KTG4V-3 . . . . . G7<br>KTG4V-3 . . . . . H7<br>KTG4V-5 . . . . . G7<br>KTG4V-5 . . . . . H7 | <br>1,45 Ω<br>7,0 Ω<br>1,68 Ω<br>7,7 Ω |
| Coil inductance, @ 1000 Hz & 150 m V:<br>KTG4V-3 . . . . . G7<br>KTG4V-3 . . . . . H7<br>KTG4V-5 . . . . . G7<br>KTG4V-5 . . . . . H7 | <br>4 mH<br>20 mH<br>8 mH<br>38 mH |
| Relative duty factor | Continuous rating<br>ED = 100% |
| Type of protection, with electrical plugs fitted correctly | IEC144 Class IP65 |
| Power capacity envelopes | See graphs on next page |
| Flow gain | See graphs commencing two pages on |
| Hysteresis, @ △p = 5 bar (72 psi) | < 8 % at rated flow |
| Step input response, @ △p = 5 bar (72 psi) per metering path<br>Required flow step:<br>KTG4V-3: 0 to 100%<br>KTG4V-3: 100% to 0<br>KTG4V-5: 0 to 100%<br>KTG4V-5: 100% to 0 | <br>Time to reach 90% of reqd. step:<br>32 ms (0.032 s)<br>30 ms (0.030 s)<br>75 ms (0.075 s)<br>50 ms (0.050 s) |
| Frequency response | See graphs three pages on |
| Reproducibility, valve-to-valve | Optimized by adjustment of deadband compensation, gain and ramp potentiometers on associated Vickers amplifier |
| Hydraulic fluids, temperature ranges and filtration recommendations | See "Contents" pages |
| Installation dimensions | See four pages on |
| Mass:<br>KTG4V-3<br>KTG4V-5 | <br>1,7 kg (3.75 lb) approx.<br>5,3 kg (11.7 lb) approx. |
| Installation and commissioning (start-up) | See "Contents" pages |

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● **Max. pressures, bar (psi)**

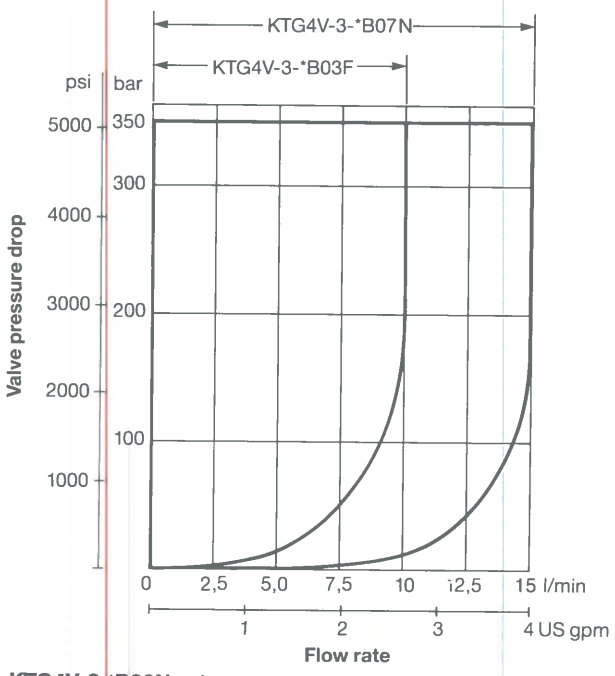
| Model | Port L condition ▲ | Ports P, A & B | T | L ▲ |
|---|---|---|---|---|
| KTG4V-3 | — | 350 (5075) | 210 (3000) | — |
| KTG4V-5 | Externally drained | 315 (4567) | 210 (3000) | 10 (145) |
| | Blocked by mating surface | | 160 (2320) | 160 (2320) |

▲ If port T pressure will not exceed 160 bar (2320 psi), port L need not be connected to tank.

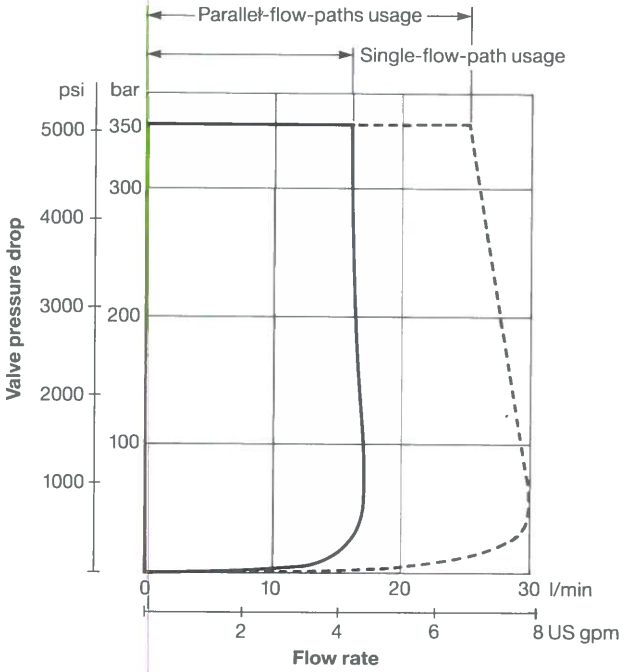
● **Power capacity envelopes**

——— Single-flow-path, P to B
– – – – Parallel-flow-paths, P to B and P to T via A.

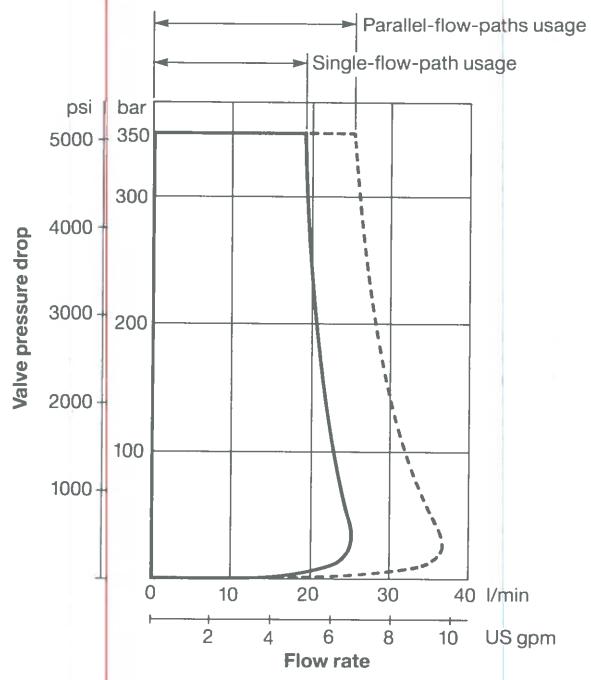
**KTG4V-3-*B03F & KTG4V-3-*B07N valves**



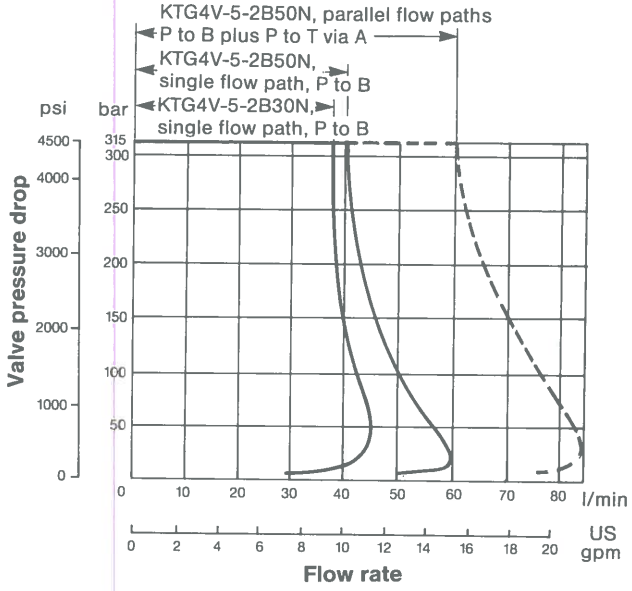

**KTG4V-3-*B13N valves**




**KTG4V-3-*B20N valves**



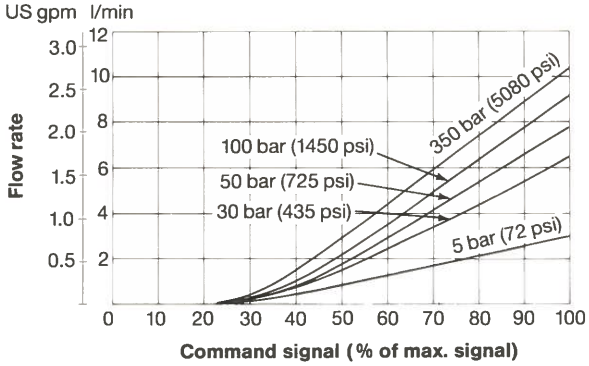

**KTG4V-5 valves**



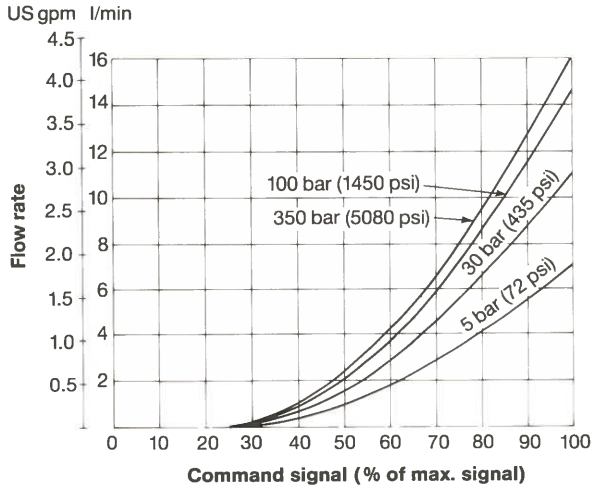
● **Flow gain**

**Single-flow-path usage**

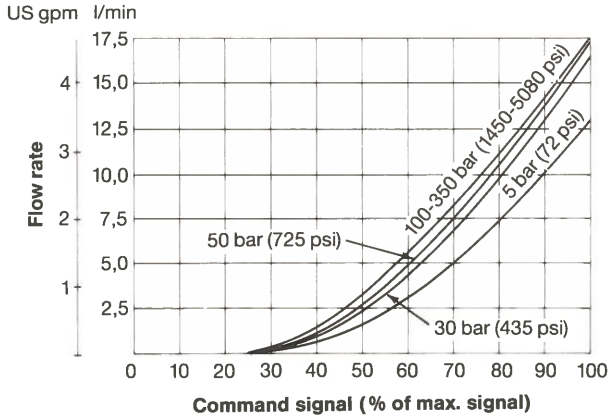
**KTG4V-3-2B03F**



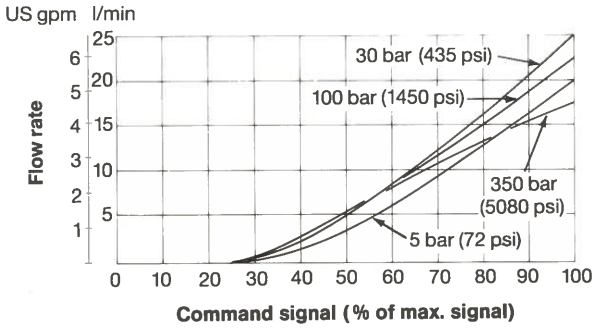

**KTG4V-3-2B07N**




**KTG4V-3-2B13N**




**KTG4V-3-2B20N**




**Parallel-flow-paths usage**

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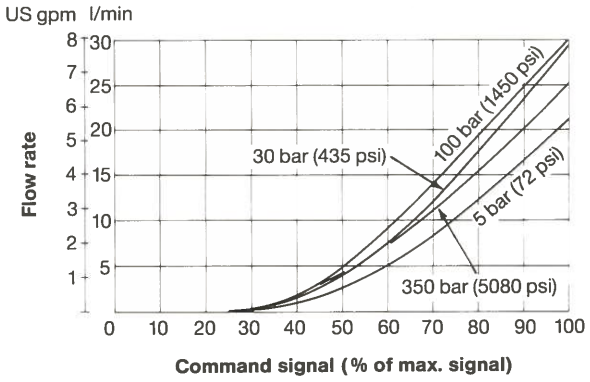
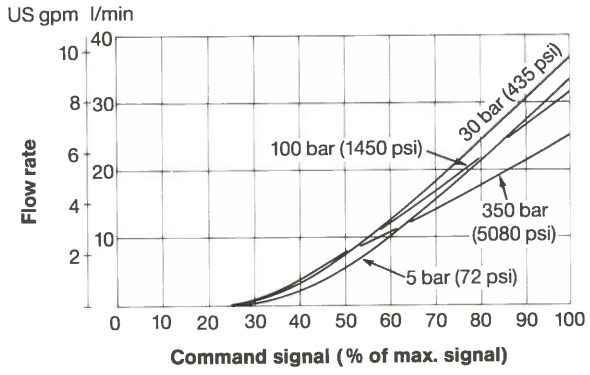
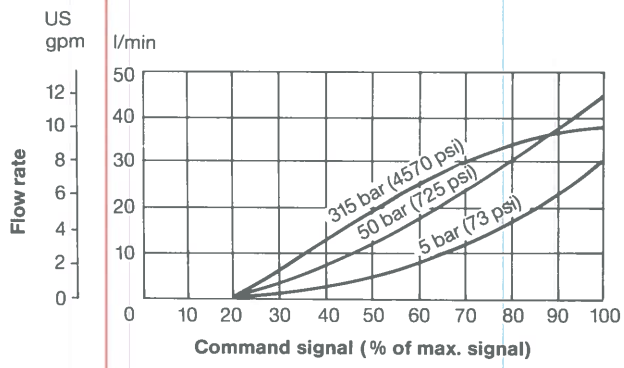


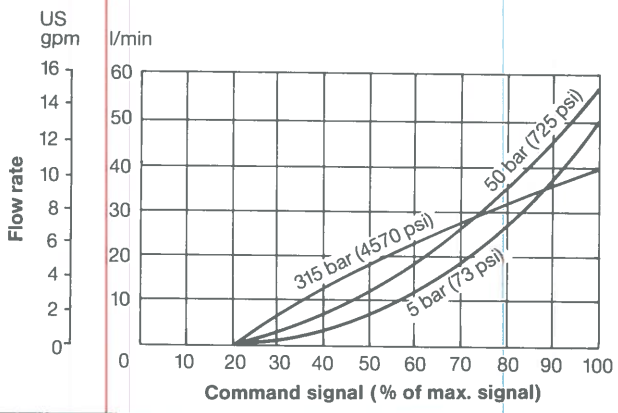



**Single-flow-path usage**

**KTG4V-5-2B30N**

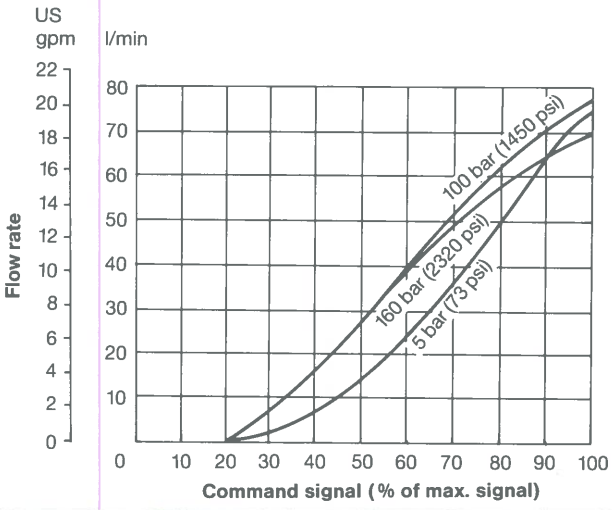



**KTG4V-5-2B50N**



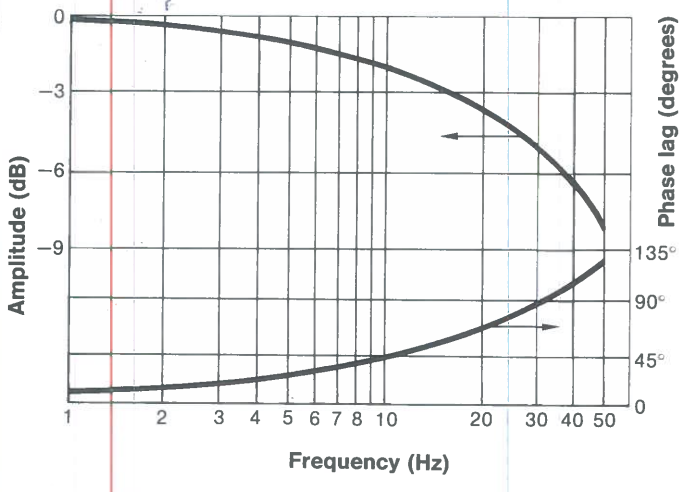

**Parallel-flow-paths usage**

**KTG4V-5-2B50N**

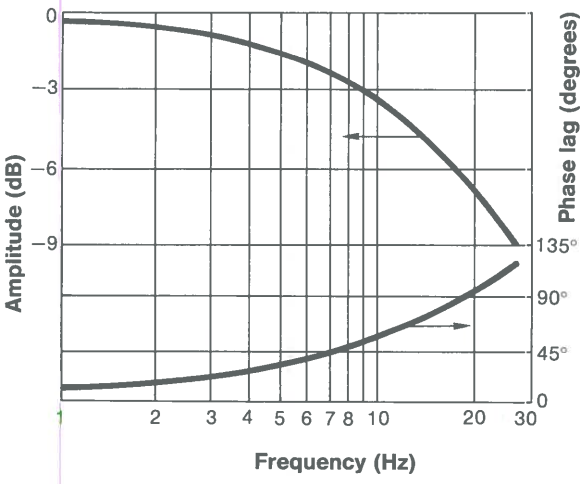



- **Frequency response**
  For an amplitude of ± 25% max. stroke about the 50% position,
  @ △p (P-B) = 5 bar (72 psi).

**KTG4V-3**



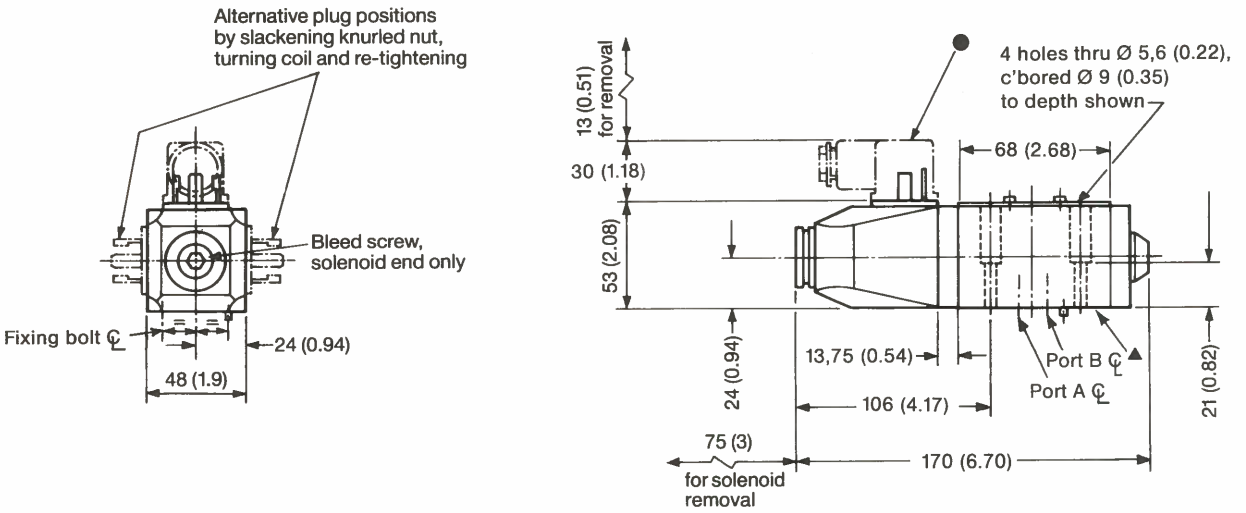

**KTG4V-5**



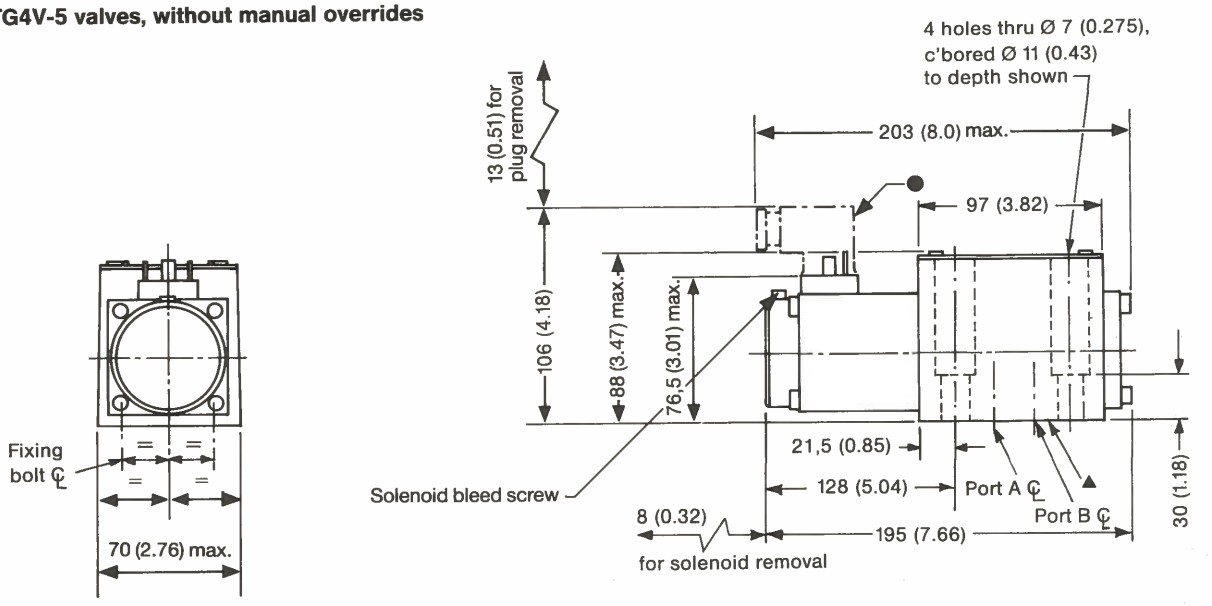
## 5. Installation dimensions in mm (inches)

3rd angle projection

### KTG4V-3 valves, without manual overrides




### KTG4V-5 valves, without manual overrides




● Electrical plug connector (without indicator light) to ISO 4400/DIN 43650. Must be ordered separately by part number:

| Part No. | Color | Solenoid coil | Cable gland | For valve |
|---|---|---|---|---|
| 710775 | Black | Sol. B | Pg. 11 Ø 6-10 (0.23-0.39 dia) | KTG4V-*-*B***(-*)-M |
| 710776 | Gray | Sol. A | | KTG4V-*-*B***(-*)-VM |

The cable entry can be repositioned at 90° intervals from the position shown. This is done by re-assembling the contact holder into the appropriate position inside the plug connector housing.

▲ Mounting surface, seals supplied. For mating surface dimensions, subplate and bolt kit options, see "Contents" pages.

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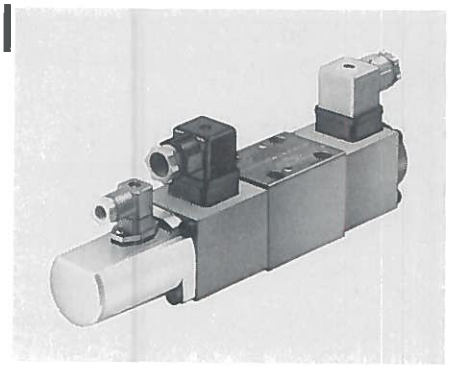
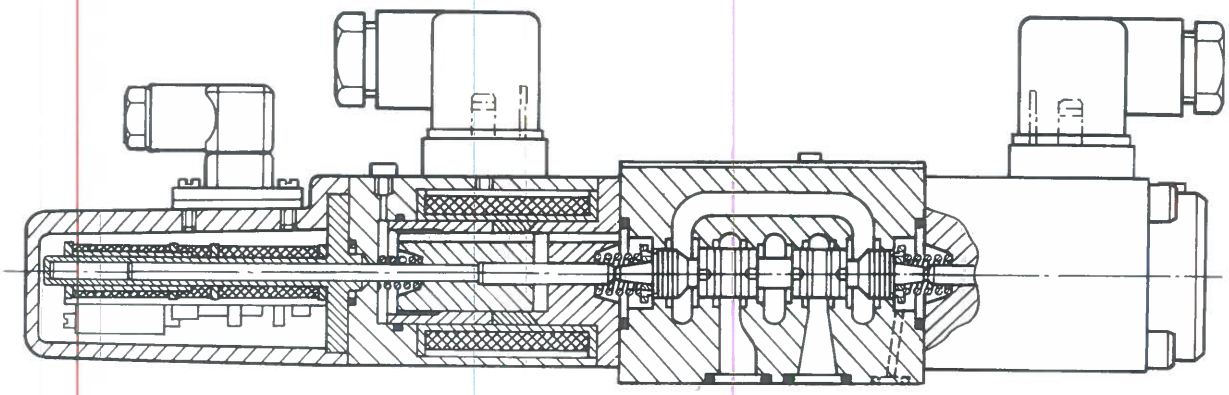
# Proportional directional control valves, single-stage design, with feedback transducers

KFDG4V-3/5, 20 series

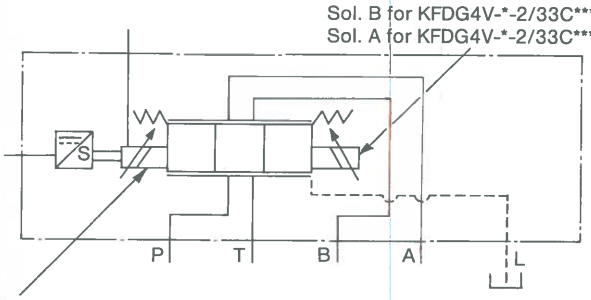
ISO 4401 sizes 03 and 05



## 1. Typical section, KFDG4V-3 valve

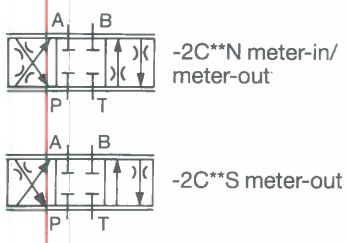


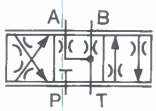
## 2. Functional symbols and applications




## Application notes

### A. Spool options




### B. Flow characteristics

These directional control valves are designed to throttle flow in proportion to command signals. There is no inherent compensation for varying loads but this can be achieved in a number of ways, either electronically or hydraulically. Your Vickers representative can advise on an arrangement to suit your application, a possible hydraulic solution being a hydrostat installed under the valve; see "Hydrostat and . . ." in "Contents" pages.

### C. Position-controlled closed-loop applications

Take account of the possible effects that the blocked port conditions may have on system performance.

## 3. Model codes

**For proportional valves**

**KFDG4V-* -**C*** -Z-(V)M-U1-**
1 2 3 4
**H* -2***
5 6

1 **Mounting size code (ISO 4401)**
3 = 03
5 = 05

2 **Spool type**
2 or 33; see "Functional symbols . . ." on previous page.

3 **Flow rating and metering**
△p = 5 bar (72 psi) per metering flow path e.g. B to T

For KFDG4V-**3** valves
07N = 7 l/min (1.85 USgpm)▲
13N = 13 l/min (3.43 USgpm)▲
20N = 20 l/min (5.28 USgpm)▲
28S = 28 l/min (7.40 USgpm)□

For KFDG4V-**5** valves
50N = 50 l/min (13.2 USgpm)▲
65S = 65 l/min (17.2 USgpm)□
70N = 70 l/min (18.5 USgpm)▲■

▲ Meter-in/meter-out
□ Meter-out only; type-2 spools only
■ Type-2 spool only

4 **Solenoid energization identity**
V = Solenoid "A" is at port "A" end and solenoid "B" at port "B" end, independent of spool type
Blank = US ANSI B93.9 standard requiring solenoid "A" energization to connect P to A and solenoid B to connect P to B

5 **Port T limit code**
6 = For 2C**S spools
7 = For all other spools

6 **Design number, 20 series**
Subject to change. Installation dimensions unaltered for design numbers 20 to 29 inclusive.

**Solenoid and LVDT plugs**
Supplied with valve.

### For supporting products
(see "Contents" pages)
- Power amplifier options
- Power supply unit options
- Electronic accessories
- Hydrostat modules
- Mounting surfaces, subplates and fastener options
- Portable test equipment

## 4. Operating data
Performance data is typical with fluid at 36 cSt (168 SUS) and 50° C (122° F) while using the basic Vickers power amplifier.

| | |
|---|---|
| Max. pressures | See table below |
| Flow rating | See 3 in "Model codes" |
| Max. current, at 50°C (122°F) ambient | 2,7A |
| Coil resistance, at 20°C (68°F): KFDG4V-3<br>KFDG4V-5 | 1,87Ω<br>2,80Ω |
| Relative duty factor | Continuous rating (ED = 100%) |
| Type of protection, with electrical plugs fitted correctly | IEC 144 Class IP65 |
| Electrical plugs, supplied with valve | See "Installation dimensions" two pages on |
| Power capacity envelopes | See graphs on next page |
| Flow gain | See graphs on next page |
| Hysteresis, with flow thru' P-A-B-T, △p = 5 bar (72 psi) per metering path e.g. P-A | <1% of max. stroke (center-to-offset) |
| Step input response, with flow thru' P-A-B-T, △p = 5 bar (72 psi) per metering path e.g. P-A<br>Required flow step:<br>KFDG4V-3 { 0 to 100%<br>100% to 0<br>+90 to −90%<br>KFDG4V-5 { 0 to 100%<br>100% to 0<br>+90 to −90% | Time to reach 90% of reqd. step:<br>18 ms (0.018s)<br>16 ms (0.016s)<br>30 ms (0.030s)<br>31 ms (0.031s)<br>32 ms (0.032s)<br>45 ms (0.045s) |
| Frequency response | See graphs two pages on |
| Reproducibility, valve-to-valve | Optimized by adjustment of deadband compensation, gain and ramp potentiometers on associated Vickers amplifier |
| Hydraulic fluids, temperature ranges and filtration recommendations | See "Contents" pages |
| Installation dimensions | See two pages on |
| Mass: KFDG4V-3<br>KFDG4V-5 | 2,65 kg (5.84 lb) approx.<br>7,2 kg (15.86 lb) approx. |
| Installation and commissioning (start-up) | See "Contents" pages |

● **Max. pressures, bar (psi)**

| Model | Port L condition ▲ | Ports P,A & B | T | L ▲ |
|---|---|---|---|---|
| KFDG4V-3-**C**N-Z-VM-U1-H7 models only | Externally drained | 350 (5075) | 210 (3000) | 10 (145) |
| All KFDG4V-3 models | Blocked■ | 315 (4567) | 160 (2320) | 160 (2320) |
| | | 350 (5075) | 105 (1522) | 105 (1522) |
| KFDG4V-5-**C**N-Z-VM-U1-H7 models only | Externally drained | 315 (4567) | 210 (3000) | 10 (145) |
| All KFDG4V-5 models | Blocked■ | | 160 (2320) | 160 (2320) |

■ By mating surface
▲ If port T pressure will not exceed 160 bar (2320 psi), port L need not be connected to tank.

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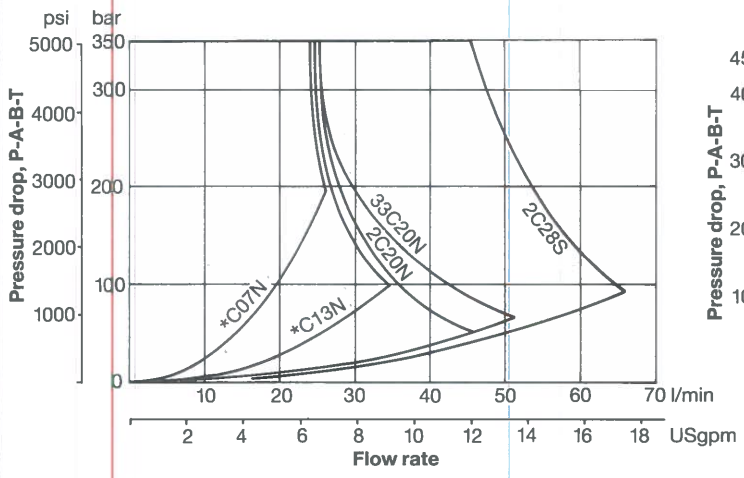
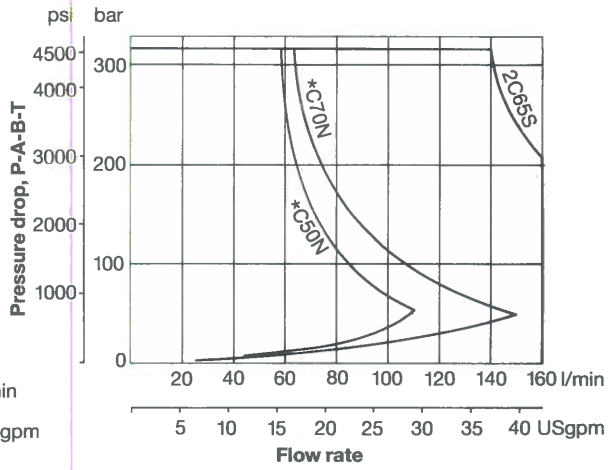
## ● Power capacity envelopes

Flow thru' P-A-B-T or P-B-A-T

**KFDG4V-3**




**KFDG4V-5**




## ● Flow gain

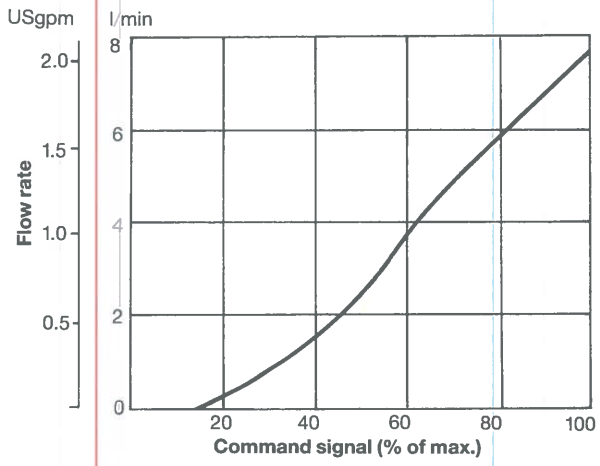
At $\triangle p$ = 5 bar (72 psi) per metering path (e.g. P-A)▲, with flow thru' P-A-B-T or P-B-A-T

▲ At other $\triangle p$ values and within the power capacity envelopes, flow rates approximate to:

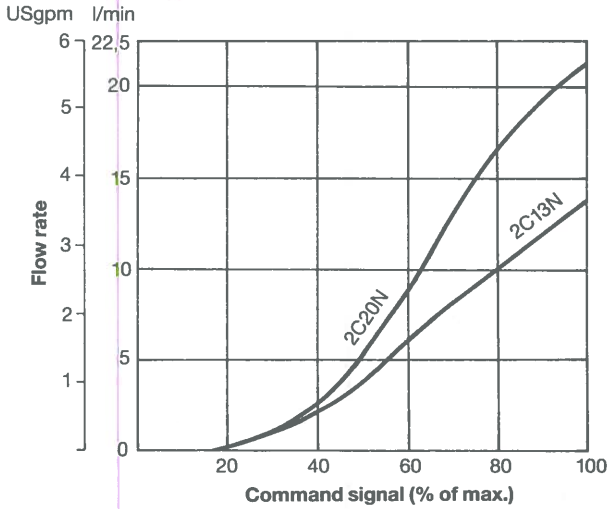
$$Q_x = Q_D \sqrt{\frac{\triangle p_x}{\triangle p_D}}$$

where $Q_D$ = Datum flow rate
$\triangle p_D$ = Pressure drop at datum flow rate
$\triangle p_x$ = Required $\triangle p$

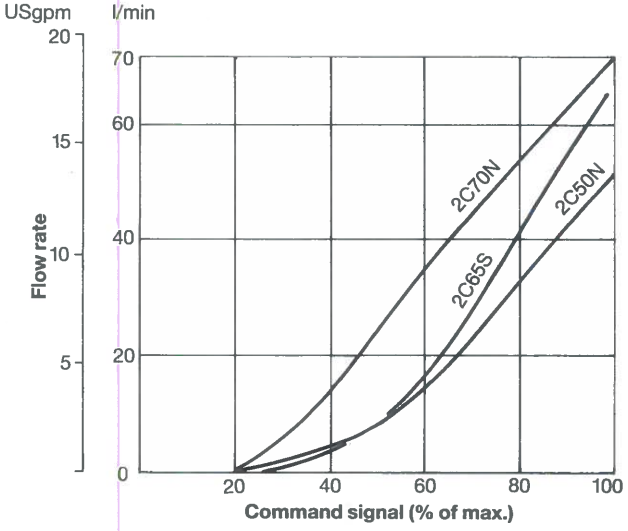
**KFDG4V-3-2C07N**



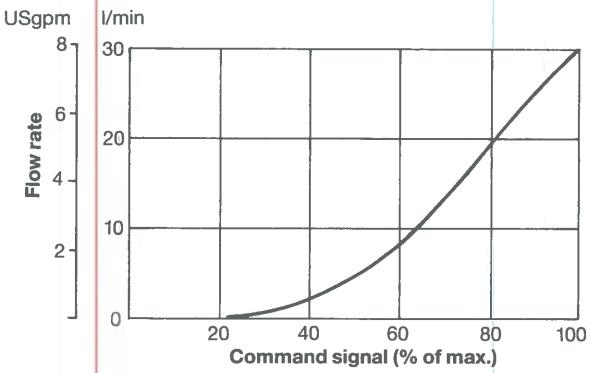

**KFDG4V-3-2C13N/20N**




**KFDG4V-5-2C50N/65S/70N**

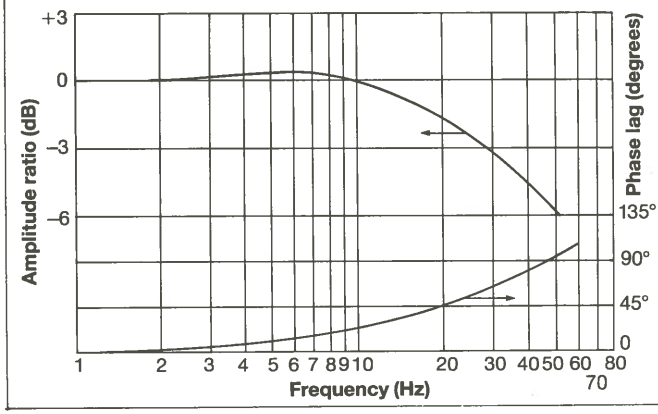



**KFDG4V-3-2C28S**

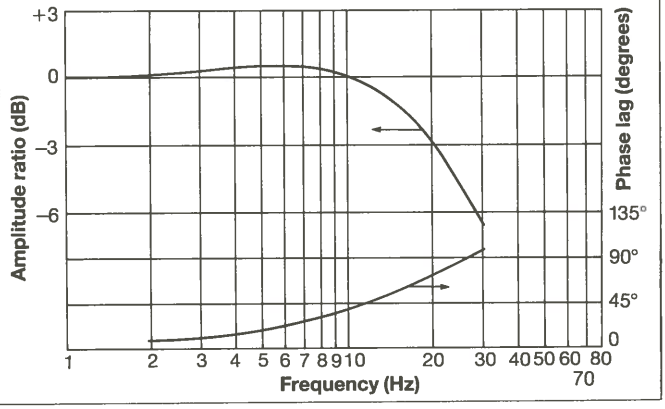


● **Frequency response**
For an amplitude of ±25% max. stroke (center-to-offset) about the 50% position and △p (P-A-B-T) = 10 bar (145 psi)

**KFDG4V-3-2C20N example**



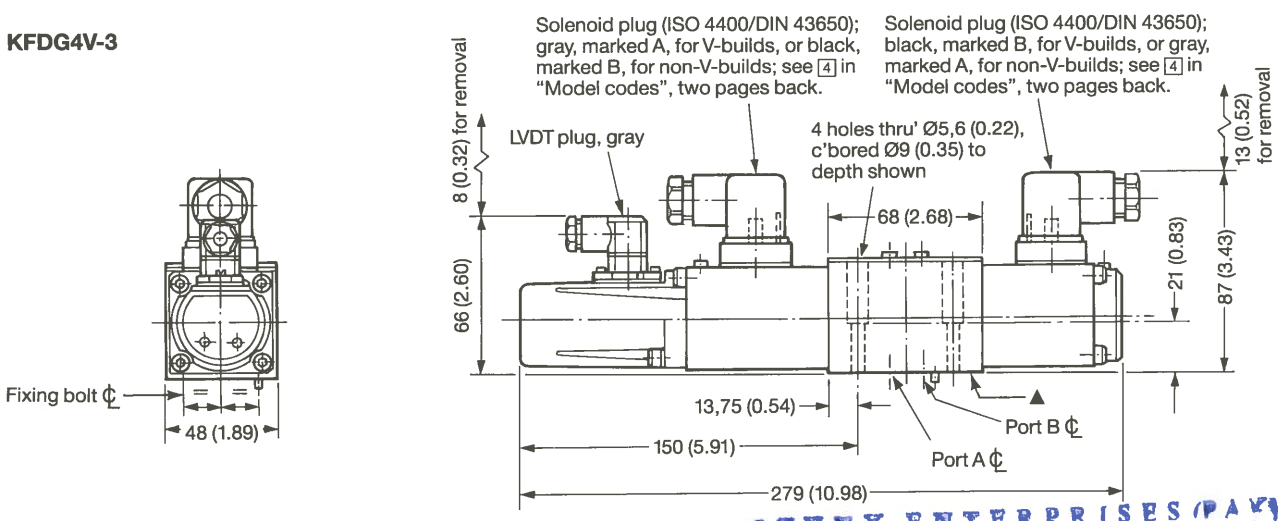

**KFDG4V-5-2C50N example**




## 5. Installation dimensions in mm (inches)

3rd angle projection

**KFDG4V-3**


Solenoid plug (ISO 4400/DIN 43650); gray, marked A, for V-builds, or black, marked B, for non-V-builds; see 4 in "Model codes", two pages back.
Solenoid plug (ISO 4400/DIN 43650); black, marked B, for V-builds, or gray, marked A, for non-V-builds; see 4 in "Model codes", two pages back.
LVDT plug, gray
4 holes thru' Ø5,6 (0.22), c'bored Ø9 (0.35) to depth shown
8 (0.32) for removal
13 (0.52) for removal
68 (2.68)
66 (2.60)
21 (0.83)
87 (3.43)
Fixing bolt ℄
48 (1.89)
13,75 (0.54)
Port B ℄
150 (5.91)
Port A ℄
279 (10.98)

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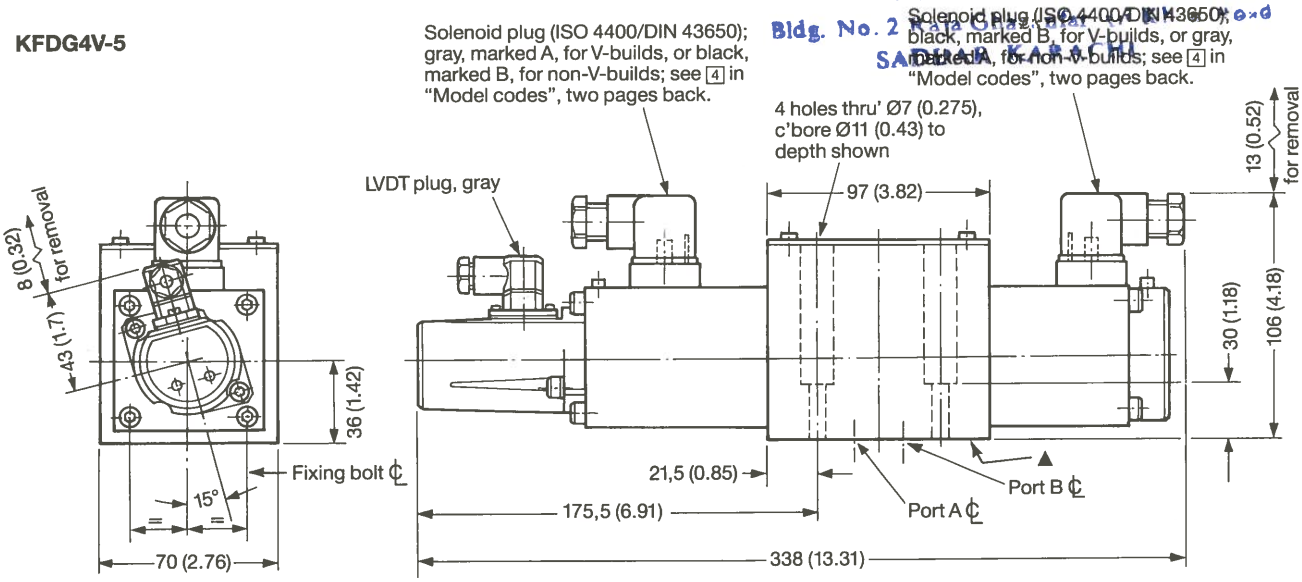
**KFDG4V-5**

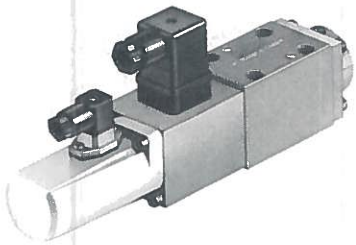

Solenoid plug (ISO 4400/DIN 43650); gray, marked A, for V-builds, or black, marked B, for non-V-builds; see 4 in "Model codes", two pages back.
Solenoid plug (ISO 4400/DIN 43650); black, marked B, for V-builds, or gray, marked A, for non-V-builds; see 4 in "Model codes", two pages back.
4 holes thru' Ø7 (0.275), c'bore Ø11 (0.43) to depth shown
LVDT plug, gray
8 (0.32) for removal
13 (0.52) for removal
97 (3.82)
43 (1.7)
36 (1.42)
30 (1.18)
106 (4.18)
Fixing bolt ℄
15°
70 (2.76)
21,5 (0.85)
Port B ℄
175,5 (6.91)
Port A ℄
338 (13.31)

▲ Mounting surface, seals supplied. For mating surface dimensions, subplate and bolt kit options, see "Contents" pages.

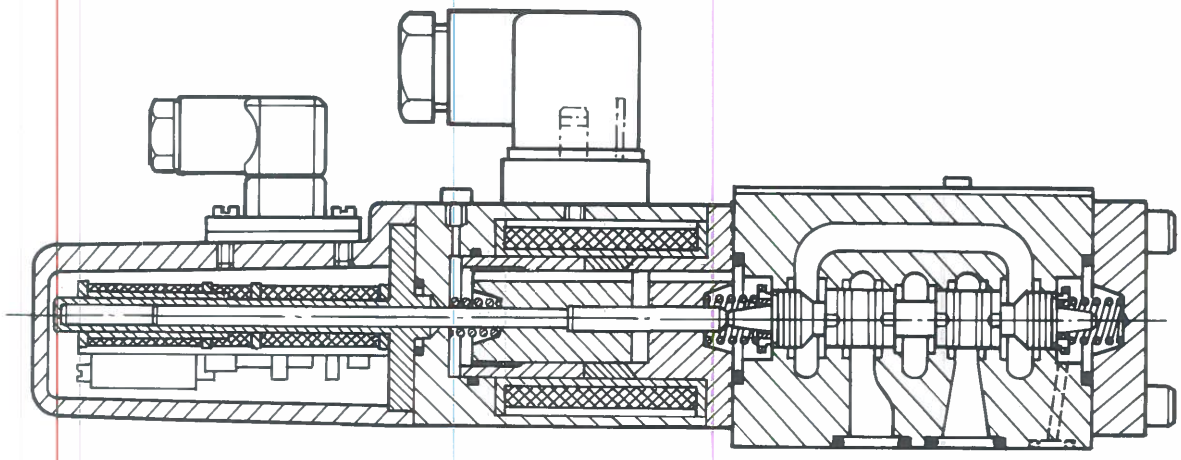
# Proportional throttle valves, with feedback transducers

KFTG4V-3/5, 20 series

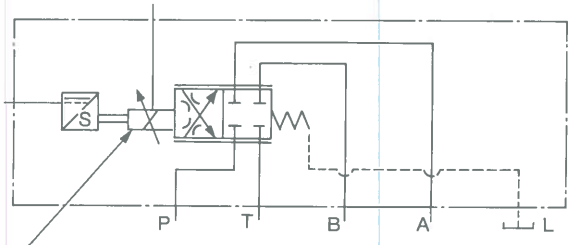
ISO 4401 sizes 03 and 05



## 1. Typical section, KFTG4V-3 valve



## 2. Functional symbols and applications




Sol. A for KFTG4V-*-2B***-*-VM valves.
Sol. B for KFTG4V-*-2B***-*-M valves.

## Application notes

**A. Flow characteristics**
KFTG4V valves are designed to throttle flow in proportion to command signals. There is no inherent compensation for varying loads but this can be achieved in a number of ways, either electronically or hydraulically. Your Vickers representative can advise on an arrangement to suit your application, a possible hydraulic solution being a hydrostat installed under the valve; see "Hydrostat and . . ." in "Contents" pages.

**B. Rated flow boost**
Flow ratings (see [2] in "Model codes" section) are based on single-flow-path usage (P to B). Higher flow rates can be obtained by arranging the porting in the mounting block into a parallel-flow-path pattern. This will boost the valve's flow capacity to a value approaching twice that of the single-flow-path rating; for a parallel-flow-path module, see "Mounting surface, . . ." in "Contents" pages.

## 3. Model codes

**For proportional valves**

**KFTG4V-* -2B***-Z-(V)M-U1-**
[1] [2] [3]

**H7-2***
[4]

[1] **Mounting size code (ISO 4401)**
3 = 03
5 = 05

[2] **Flow rating**
Single flow path at △p = 5 bar (72 psi)
For KFTG4V-**3** valves:
07N = 7 l/min (1.85 USgpm)
13N = 13 l/min (3.43 USgpm)
20N = 20 l/min (5.28 USgpm)
For KFTG4V-**5** valves:
50N = 50 l/min (13.2 USgpm)
70N = 70 l/min (18.5 USgpm)

[3] **Solenoid energization identity**
V = Solenoid A at port A end (German practice)
Blank = Solenoid B energized selects P to B (US ANSI B93.9 standard)

[4] **Design number, 20 series**
Subject to change. Installation dimensions unaltered for design numbers 20 to 29 inclusive.

**Solenoid and LVDT plugs**
Supplied with valve.

### For supporting products

(see "Contents" pages)
- Power amplifier options
- Power supply unit options
- Electronic accessories
- Hydrostat modules
- Mounting surfaces, subplates, parallel-flow-path modules and fastener options
- Portable test equipment

## 4. Operating data

Performance data is typical with fluid at 36 cSt (168 SUS) and 50° C (122° F) while using the basic Vickers power amplifier.

| | |
|---|---|
| Max. pressures | See table below |
| Flow rating | See [2] in "Model codes" |
| Max. current, at 50°C (122°F) ambient | 2,7A |
| Coil resistance, at 20°C (68°F): KFTG4V-3<br>KFTG4V-5 | 1,87Ω<br>2,80Ω |
| Relative duty factor | Continuous rating (ED = 100%) |
| Type of protection, with electrical plugs fitted correctly | IEC 144 Class IP65 |
| Electrical plugs, supplied with valve | See "Installation dimensions" two pages on |
| Power capacity envelopes | See graphs on next page |
| Flow gain | See graphs on next page |
| Hysteresis, at △p = 5 bar (72 psi) | <1% of max. stroke |
| Step input response, at △p = 5 bar (72 psi)<br>Required flow step:<br>KFTG4V-3 {0 to 100%<br>{100 to 0%<br>KFTG4V-5 {0 to 100%<br>{100 to 0% | Time to reach 90% of reqd. step:<br>18 ms (0.018s)<br>16 ms (0.016s)<br>30 ms (0.030s)<br>32 ms (0.032s) |
| Frequency response | See graphs two pages on |
| Reproducibility, valve-to-valve | Optimized by adjustment of deadband compensation, gain and ramp potentiometers on associated Vickers amplifier |
| Hydraulic fluids, temperature ranges and filtration recommendations | See "Contents" pages |
| Installation dimensions | See two pages on |
| Mass: KFTG4V-3<br>KFTG4V-5 | 2,09 kg (4.6 lb) approx.<br>5,5 kg (12.1 lb) approx. |
| Installation and commissioning (start-up) | See "Contents" pages |

● **Max. pressures, bar (psi)**

| Model | Port L condition ■ | Ports P, A & B | T | L ■ |
|---|---|---|---|---|
| KFTG4V-3 | Externally drained | 350 (5075) | 210 (3000) | 10 (145) |
| | Blocked▲ | 315 (4567) | 160 (2320) | 160 (2320) |
| | | 350 (5075) | 105 (1522) | 105 (1522) |
| KFTG4V-5 | Externally drained | 315 (4567) | 210 (3000) | 10 (145) |
| | Blocked▲ | | 160 (2320) | 160 (2320) |

▲ By mating surface

■ If port T pressure will not exceed 160 bar (2320 psi), port L need not be connected to tank.

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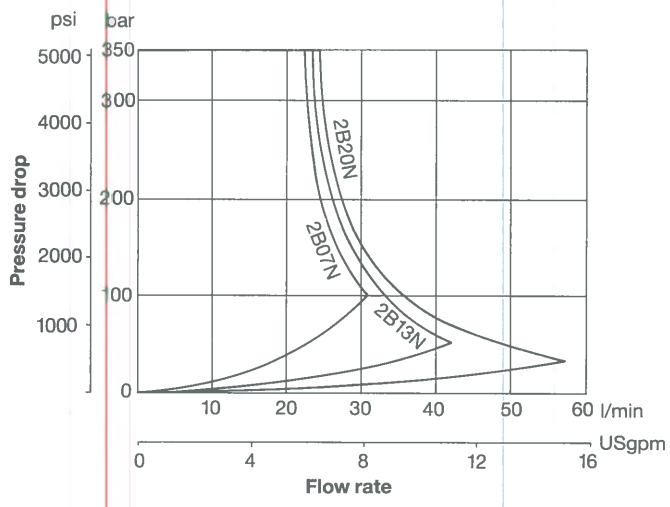
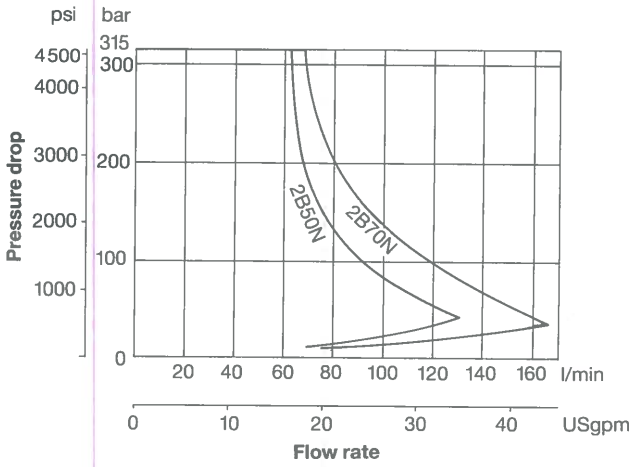
## ● Power capacity envelopes

Flow from P to B◪

**KFTG4V-3**



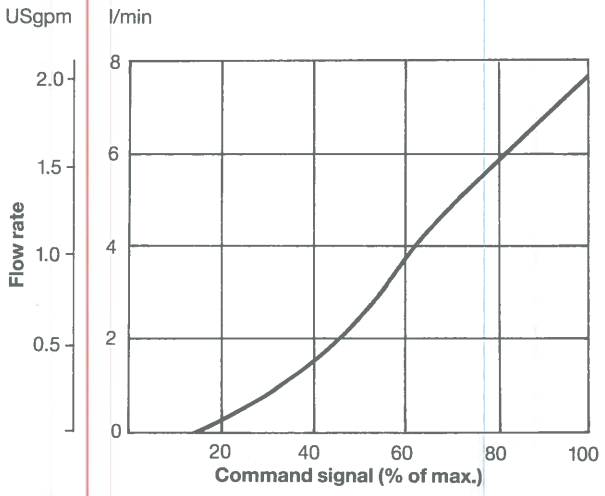

**KFTG4V-5**



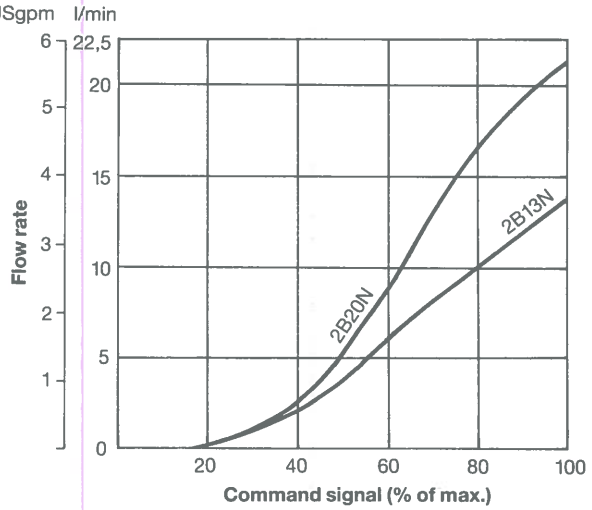

## ● Flow gain

Flow from P to B◪ at △p = 5 bar (72 psi)▲.

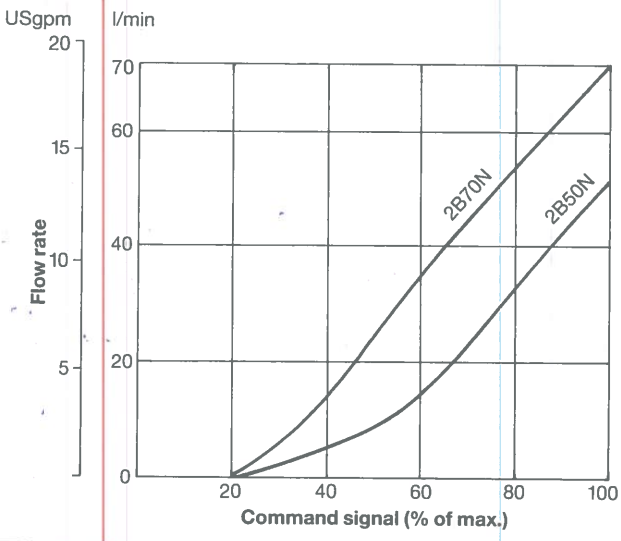
**KFTG4V-3-2B07N**




**KFTG4V-3-2B13N/20N**




**KFTG4V-5**




◪ Single-flow-path condition. For parallel-flow-path conditions (P & A to B & T) see under "Rated flow boost" two pages back.

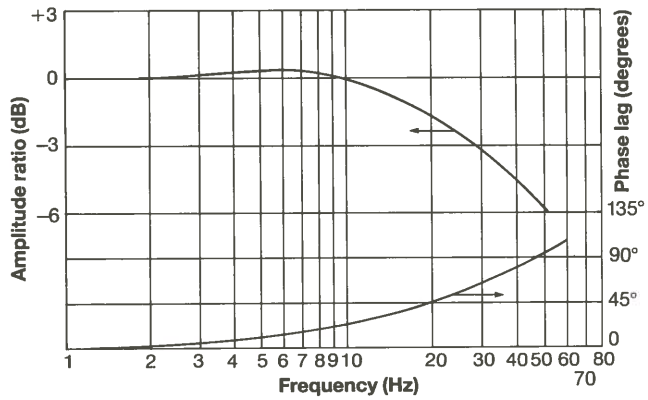
▲ At other △p values and within the power capacity envelopes, flow rates approximate to:

$$Q_x = Q_D \sqrt{\frac{\Delta p_x}{\Delta p_D}}$$

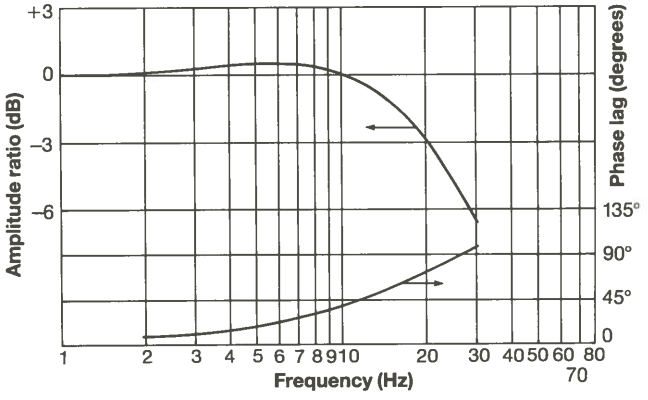
where $Q_D$ = Datum flow rate
$\Delta p_D$ = Pressure drop at datum flow rate
$\Delta p_x$ = Required △p

● **Frequency response**
For an amplitude of ±25% max. stroke about the 50% position, at △p (P-B) = 5 bar (72 psi)

**KFTG4V-3-2B20N example**



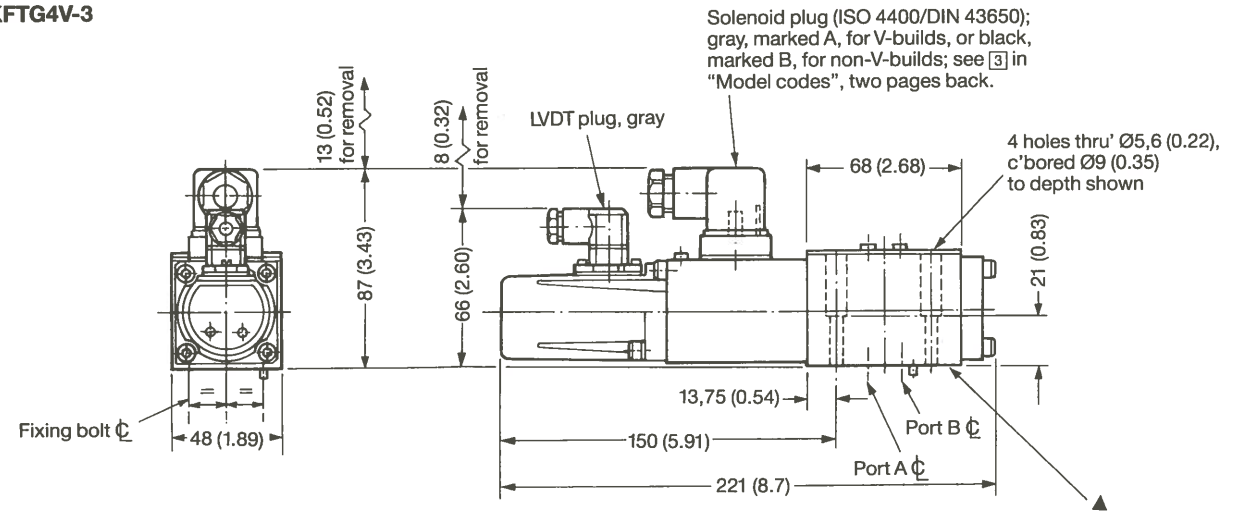

**KFTG4V-5-2B50N example**



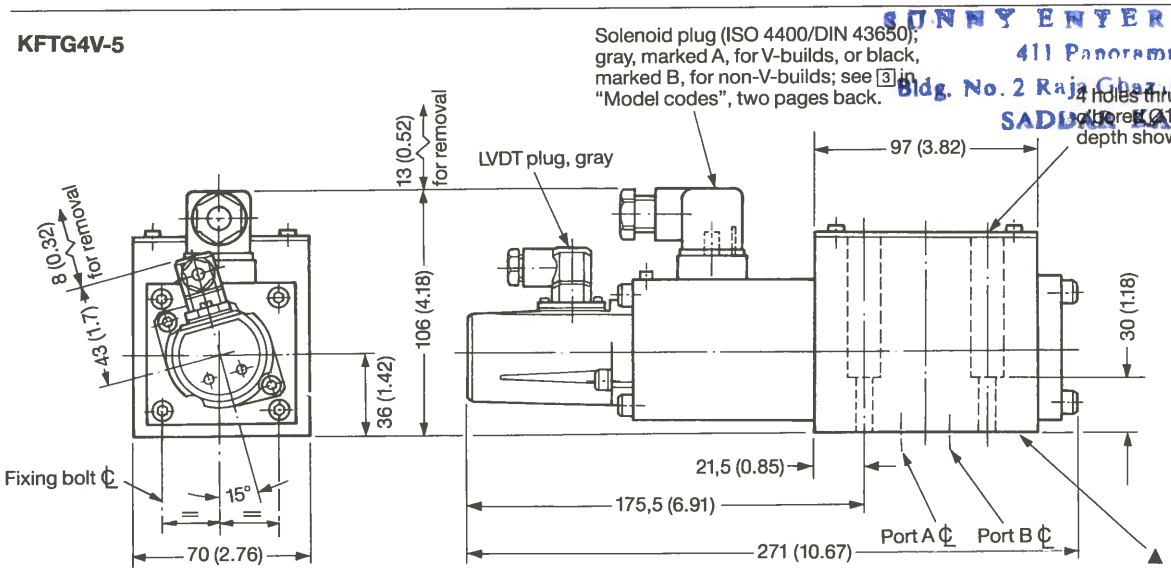

## 5. Installation dimensions in mm (inches)

3rd angle projection

**KFTG4V-3**


Solenoid plug (ISO 4400/DIN 43650); gray, marked A, for V-builds, or black, marked B, for non-V-builds; see 3 in "Model codes", two pages back.
LVDT plug, gray
13 (0.52) for removal
8 (0.32) for removal
87 (3.43)
66 (2.60)
68 (2.68)
4 holes thru' Ø5,6 (0.22), c'bored Ø9 (0.35) to depth shown
21 (0.83)
13,75 (0.54)
Port B ℄
Port A ℄
150 (5.91)
221 (8.7)
Fixing bolt ℄
48 (1.89)

**KFTG4V-5**


Solenoid plug (ISO 4400/DIN 43650); gray, marked A, for V-builds, or black, marked B, for non-V-builds; see 3 in "Model codes", two pages back.
LVDT plug, gray
13 (0.52) for removal
8 (0.32) for removal
43 (1.7)
106 (4.18)
36 (1.42)
97 (3.82)
4 holes thru' Ø7 (0.275), c'bored Ø11 (0.43) to depth shown
30 (1.18)
21,5 (0.85)
175,5 (6.91)
271 (10.67)
Port A ℄
Port B ℄
Fixing bolt ℄
15°
70 (2.76)

▲ Mounting surface, seals supplied. For mating surface dimensions, subplate and bolt kit options, see "Contents" pages.

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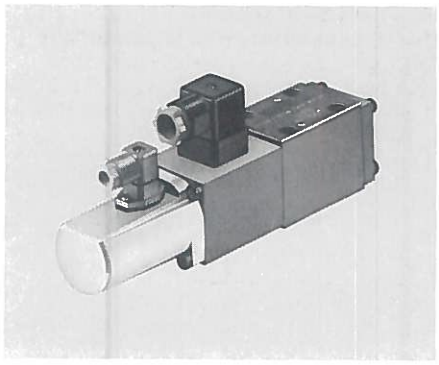
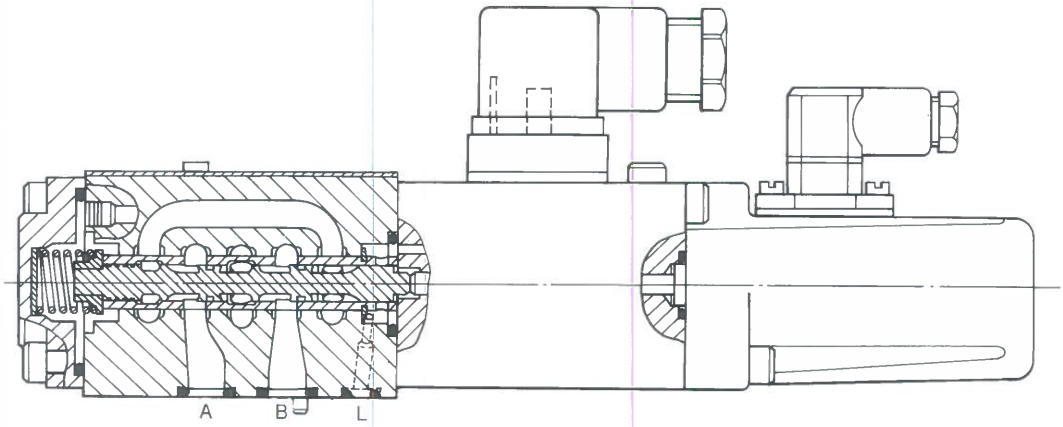
# Solenoid operated proportional valves for position-controlled, closed-loop applications

KSDG4V-3, 10 series
ISO 4401 size 03



## 1. Typical section




## 2. Functional symbols

**KSDG4V-3-92L**

**KSDG4V-3-96L**

## 3. General characteristics

These four-way solenoid operated proportional valves have a high dynamic performance which enables them to be used in closed-loop applications, previously possible only when servo valves were used. Various spool options are available for rated flows up to 40 l/min (10.6 US gpm). The spool position is monitored by an LVDT which feeds back information to the amplifier enabling spool positions to be accurately maintained.

## 4. Model codes

**For proportional valves**

**KSDG4V-3- * * L- ** -M-U1-H7-1***

1 2 3 4

1 **Spool type, center condition**
9 = Zero/underlap

2 **Spool type, spring offset condition**
2 = Ports P, A, B & T blocked
6 = Port P blocked, A & B to tank

3 **Rated flow at 70 bar (1000 psi) loop Δp pressure drop**
05 = 5 l/min (1.3 US gpm)
12 = 12 l/min (3.2 US gpm)
24 = 24 l/min (6.3 US gpm)
40 = 40 l/min (10.6 US gpm)

4 **Design number**
10 series
Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.

**Solenoid and LVDT plugs**
Supplied with valve.

For supporting products
(See "Contents" pages)

- Power amplifier options
- Power supply unit options
- Electronic accessories
- Mounting surface, subplates and bolt kit options
- Portable test equipment

## 5. Operating data

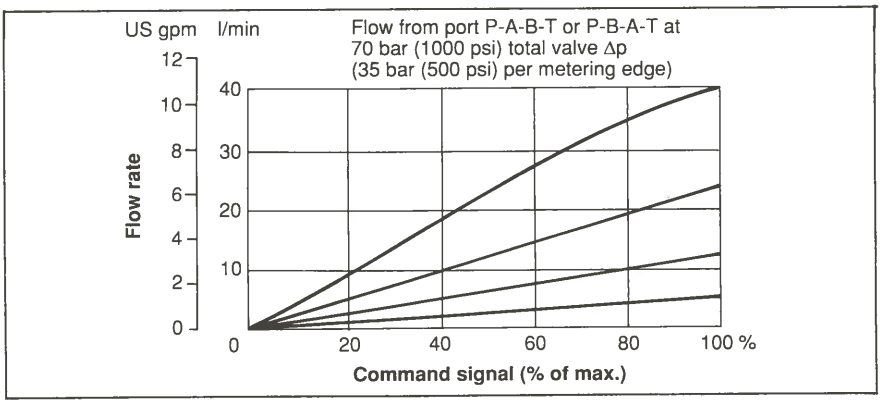
Performance is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F) while using the basic Vickers power amplifier.

| | |
|---|---|
| Max. pressures | See table below |
| Flow ratings | See [3] in "Model codes" |
| Standing current at null | 1,7A |
| Max. current at 50°C (122°F) ambient | 3,2A |
| Coil resistance at 20°C (68°F) | 1,87Ω |
| Max. solenoid power | 30W |
| Relative duty factor | Continuous rating (ED = 100%) |
| Type of protection | IEC 144, Class IP65 |
| Flow gain | See graph below |
| Pressure gain | See graph below |
| Power capacity envelopes | See graphs on next page |
| Frequency response | See table on next page |
| Hysteresis | <0,5% |
| Repeatability | <2% |
| Step response<br><br>Step size (% of max. spool stroke):<br>0 to 100 or 100 to 0<br>10 to 90 or 90 to 10<br>25 to 75 or 75 to 25<br>90 to 90 | <br><br>Time to reach 90% of step change:<br>12 ms<br>10 ms<br>7 ms<br>21 ms |
| LVDT supply voltage | +15V DC |
| LVDT output signal | 4–20 mA |
| Base amplifier | EEA-PAM-553-A-3*. Power requirements 20-40V DC at 40W |

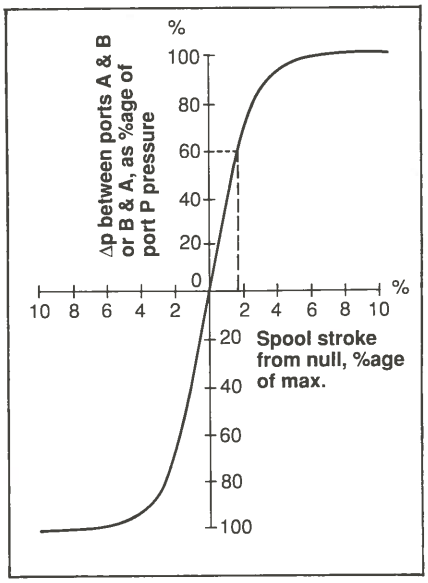
● **Maximum pressures, bar (psi)**

| Port "L" condition | Ports P, A & B | Port T | Port L |
|---|---|---|---|
| Blocked by mating surface | 350 (5000) | 50 (720) | 50 (720) |
| Externally drained | 350 (5000) | 210 (3000) | 10 (145) |

● **Flow gain**




● **Pressure gain**

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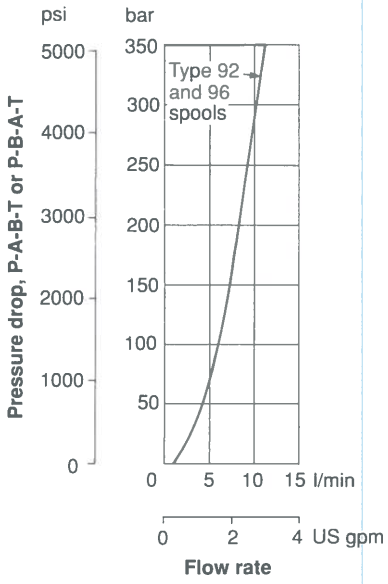
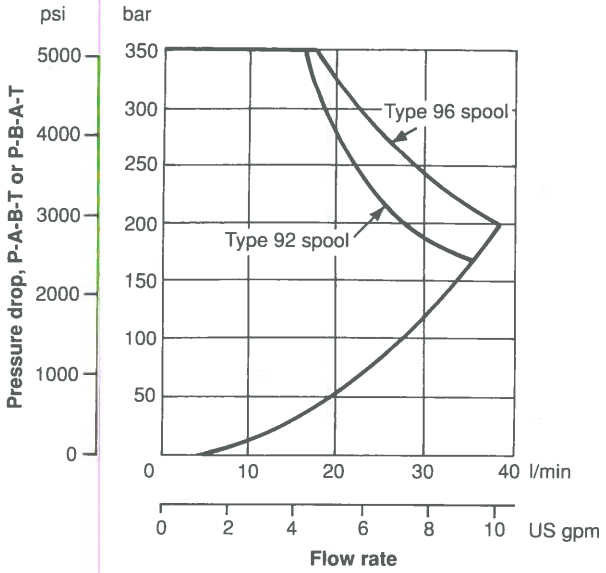
## ● Power capacity envelopes

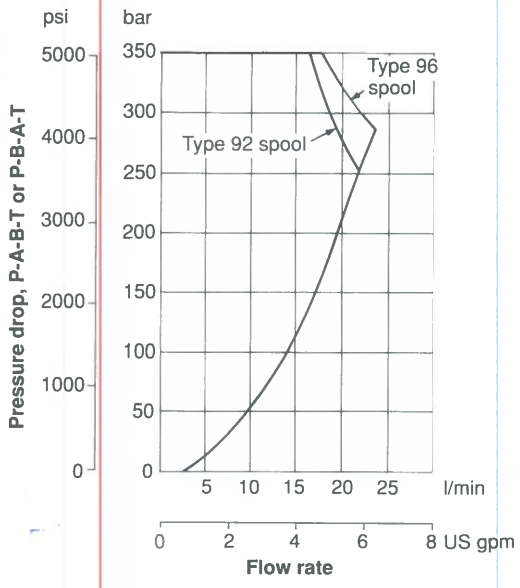
### KSDG4V-3-9*L-05 valves



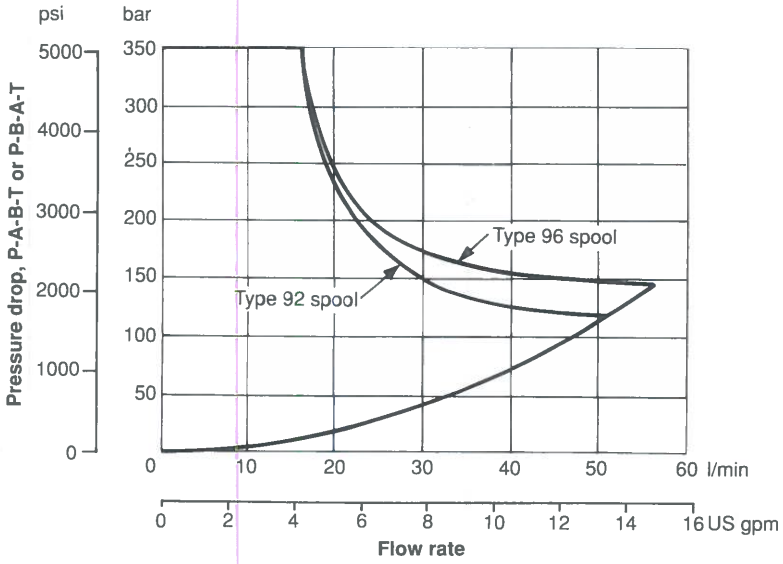

### KSDG4V-3-9*L-24 valves




### KSDG4V-3-9*L-12 valves




### KSDG4V-3-9*L-40 valves



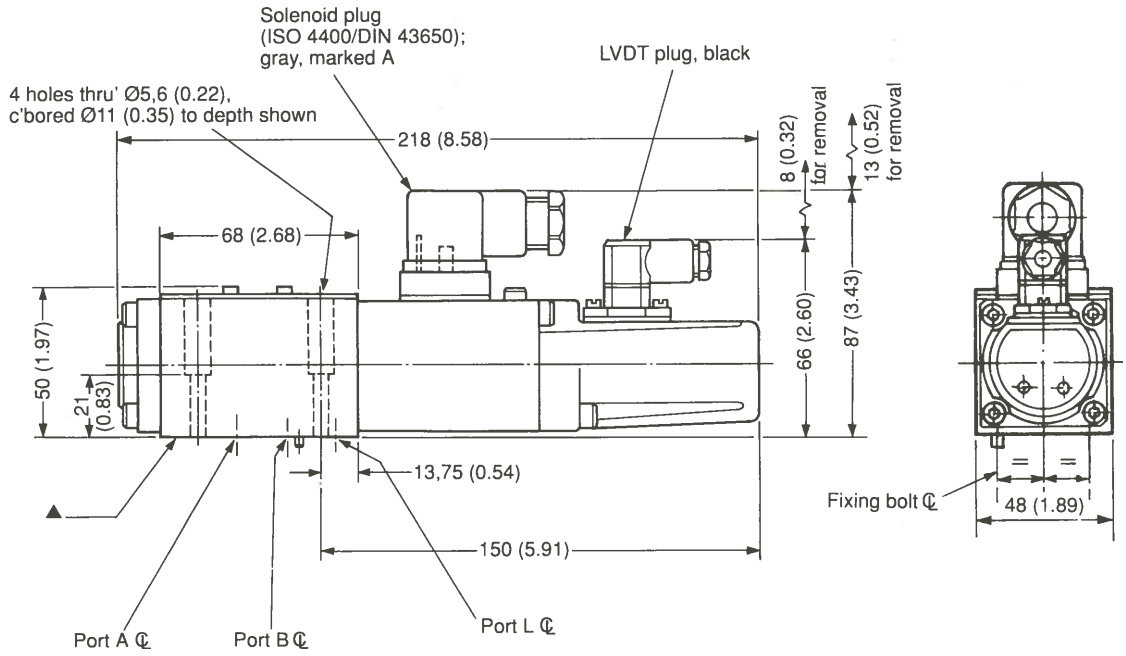

## ● Frequency response

At valve Δp = 70 bar (1000 psi), from port P-A-B-T or P-B-A-T

| Amplitude (% of max. spool stroke) | At amplitude ratio of –3dB | At phase angle of 90° |
|---|---|---|
| ±50% | 71 Hz | 76 Hz |
| ±25% | 120 Hz | 100 Hz |
| ±5% | 155 Hz | 114 Hz |

## 6. Installation dimensions in mm (inches)

3rd angle projection




▲ Mounting surface, seals supplied. For mating surface dimensions, subplate and bolt kit options, see "Contents" pages.

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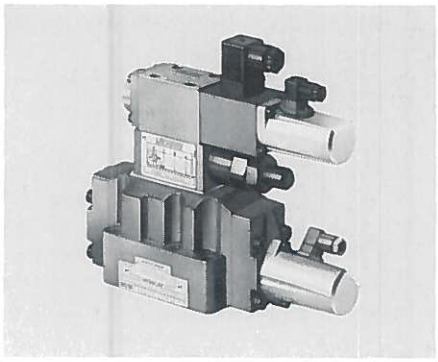
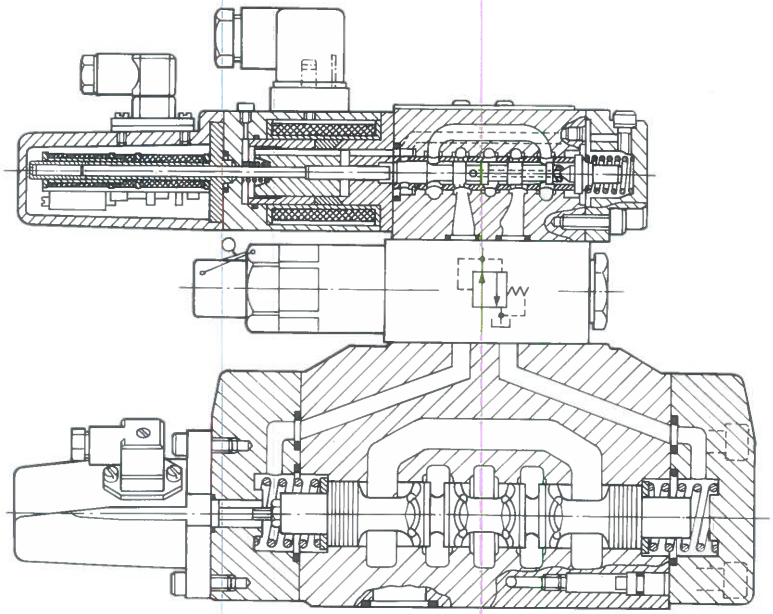
# Proportional directional control valves, two-stage design

KFDG5V-5, 30 series and KFDG5V-7/8, 10 series, with main-stage feedback transducers
KHDG5V-5/7/8, 20 series, with pilot and main stage feedback transducers

ISO 4401 sizes 05, 07 and 08



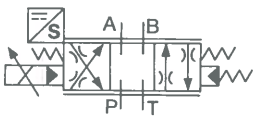
## 1. Typical section, KHDG5V-7 example



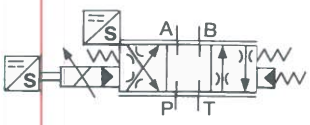
## 2. Functional symbols and application notes

**Simplified symbols**

KFDG5V models



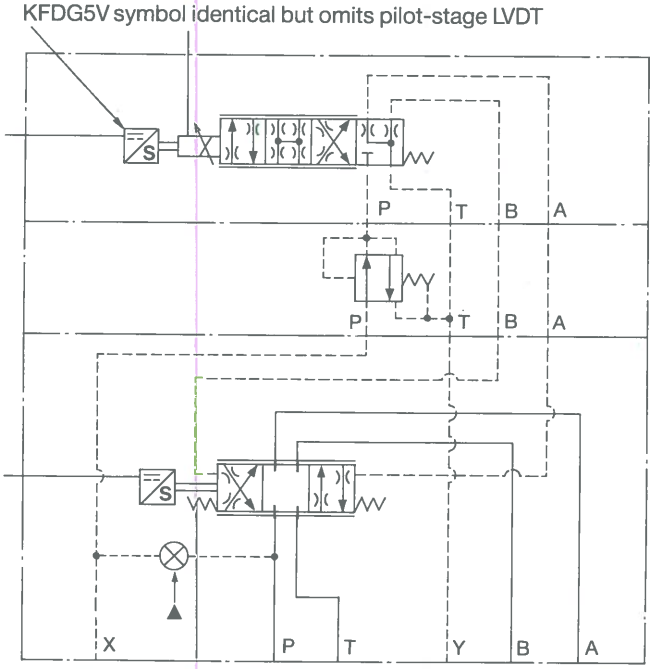

KHDG5V models




▲ See "Application note B" and [5] in "Model codes" on next page.

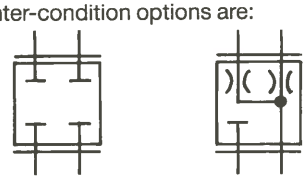
**Detailed symbol, KHDG5V example**

KFDG5V symbol identical but omits pilot-stage LVDT



## Application notes

**A. Main-spool options**
Spools shown are meter-in/meter-out types
Center-condition options are:



Type 2 spool  Type 33 spool

**B. Internally piloted models**
Differ from detailed symbol on previous page by omission of plug ▲ and the blocking of port X by the mating surface.

**C. Flow characteristics**
These valves are designed to throttle flow in proportion to command signals. There is no inherent compensation for varying loads but this can be achieved in a number of ways, either electronically or hydraulically. Your Vickers representative can advise on an arrangement to suit your application, a possible hydraulic solution for K*DG5V-7/8 valves being a hydrostat (with associated pilot shuttle adaptor) installed under the valve; see "Contents" pages.

## 3. Model codes

**For proportional valves**

**K * DG5V- * -**C****-(E)X-VM-U1**
[1] [2] [3] [4] [5]

**-H1- **
[6]

[1] **Feedback arrangement**
F = From main stage only
H = From pilot and main stages

[2] **Mounting size code (ISO 4401)**
5 = 05 (KHDG5V models only)
7 = 07
8 = 08

[3] **Spool type**
2 or 33; see "Application note A" above.

[4] **Flow rating and metering**
At △p = 5 bar (72 psi) per metering path
For K*DG5V-**5** valves:
100N = 100 l/min (26 USgpm), for type 2 spools
80N = 80 l/min (21 US gpm), for type 33 spools
For K*DG5V-**7** valves:
200N = 200 l/min (52 USgpm), for type 2 spools
160N = 160 l/min (42 USgpm), for type 33 spools
For K*DG5V-**8** valves:
300N = 300 l/min (79 USgpm), for type 2 spools
270N = 270 l/min (71 USgpm), for type 33 spools

[5] **Pilot supply**
EX = External thru' integral reducer
X = Internal thru' integral reducer

[6] **Design number**
10 series for KFDG5V-7/8 models
20 series for KH models
30 series for KFDG5V-5 models
Subject to change. Installation dimensions unaltered for design numbers *0 to *9 inclusive.

**Solenoid and LVDT plugs**
Supplied with valve.

## For supporting products
(see "Contents" pages)
- Power amplifier options
- Power supply unit options
- Electronic accessories
- Pressure hydrostat and pilot shuttle adaptor options
- Mounting surfaces, subplates and bolt kit options
- Portable test equipment

## 4. Operating data
Performance data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F) while using the basic Vickers power amplifier.

| | |
|---|---|
| Max. pressures | See table on next page |
| Flow rating | See [4] in "Model codes" |
| Standing current, pilot valve at null: KFDG5V<br>KHDG5V | 1,4A<br>1,6A |
| Max. current, at 50°C (122°F) ambient | 2,7A |
| Coil resistance, at 20°C (68°F): KFDG5V<br>KHDG5V | 2,8Ω<br>1,7Ω |
| Relative duty factor | Continuous rating (ED = 100%) |
| Type of protection, with electrical plugs fitted correctly | To IEC 144 Class IP65 |
| Electrical plugs, supplied with valve | See "Installation dimensions" commencing two pages on |
| Power capacity envelopes<br>Max. recommended flow rate at stated valve pressure drop: KFDG5V-5<br>KFDG5V-7<br>KFDG5V-8<br>KHDG5V-5<br>KHDG5V-7<br>KHDG5V-8 | <br>150 l/min (39 USgpm)■<br>350 l/min (92 USgpm)▲<br>450 l/min (118 USgpm)▲<br>150 l/min (39 USgpm)■<br>450 l/min (118 USgpm)▲<br>900 l/min (237 USgpm)▲<br>▲ At △p = 350 bar (5075 psi)<br>■ At △p = 315 bar (4567 psi) |
| Flow gain | See graphs on next page |
| Hysteresis, with flow thru' P-A-B-T, △p = 5 bar (72 psi) per metering path (P-A or B-T): KFDG5V<br>KHDG5V | <2%<br><1% |
| Step input response, with flow thru' P-A-B-T, △p = 5 bar (72 psi) per metering path e.g. P-A, and with max. deadband compensation. Required flow step: | Time to reach 90% of reqd. step: |
| KFDG5V-5 { 0 to 100% | 30 ms (0.030s) |
| 100% to 0 | 24 ms (0.024s) |
| +90 to −90% | 34 ms (0.034s) |
| KFDG5V-7 { 0 to 100% | 50 ms (0.050s) |
| 100% to 0 | 54 ms (0.054s) |
| +90 to −90% | 61 ms (0.061s) |
| KFDG5V-8 { 0 to 100% | 67 ms (0.067s) |
| 100% to 0 | 56 ms (0.056s) |
| +90 to −90% | 75 ms (0.075s) |
| KHDG5V-5 { 0 to 100% | 24 ms (0.024s) |
| 100% to 0 | 23 ms (0.023s) |
| +90 to −90% | 35 ms (0.035s) |
| KHDG5V-7 { 0 to 100% | 24 ms (0.024s) |
| 100% to 0 | 23 ms (0.023s) |
| +90 to −90% | 36 ms (0.036s) |
| KHDG5V-8 { 0 to 100% | 37 ms (0.037s) |
| 100% to 0 | 36 ms (0.036s) |
| +90 to −90% | 57 ms (0.057s) |
| Frequency response | See graphs two pages on |

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*Continued on next page*

| | |
|---|---|
| Reproducibility, valve-to-valve | Optimized by adjustment of deadband compensation, gain and ramp potentiometers on associated Vickers amplifier |
| Hydraulic fluids, temperature ranges and filtration recommendations | See "Contents" pages |
| Installation dimensions | See next four pages |
| Mass: KFDG5V-5<br>KFDG5V-7<br>KFDG5V-8<br>KHDG5V-5<br>KHDG5V-7<br>KHDG5V-8 | 9,50 kg (20.9 lb) approx.<br>10,75 kg (23.7 lb) approx.<br>18,00 kg (39.7 lb) approx.<br>9,75 kg (21.5 lb) approx.<br>11,00 kg (24.2 lb) approx.<br>18,25 kg (40.2 lb) approx. |
| Installation and commissioning (start-up) | See "Contents" pages |

● **Max. pressures, bar (psi)**

| Model | Pilot pressure source | Ports P, A & B | T | X | Y |
|---|---|---|---|---|---|
| KFDG5V-7/8 | Internal or external | 350 (5075)▲ | 350 (5075) | 350 (5075)▲ | 4 (58) |
| K*DG5V-5 | External | 315 (4567) | 210 (3000) | 210 (3000)◪ | 4 (58) |
| | Internal | 315 (4567)◪ | 100 (1450) | 315 (4567)◪ | 4 (58) |
| KHDG5V-7/8 | Internal or external | 350 (5075)◪ | 350 (5075) | 350 (5075)◪ | 4 (58) |

▲ 25 (363) min. pressure at X for externally piloted models or at P & X for internally piloted models.
◪ 45 (653) min. pressure at X for externally piloted models or at P & X for internally piloted models.

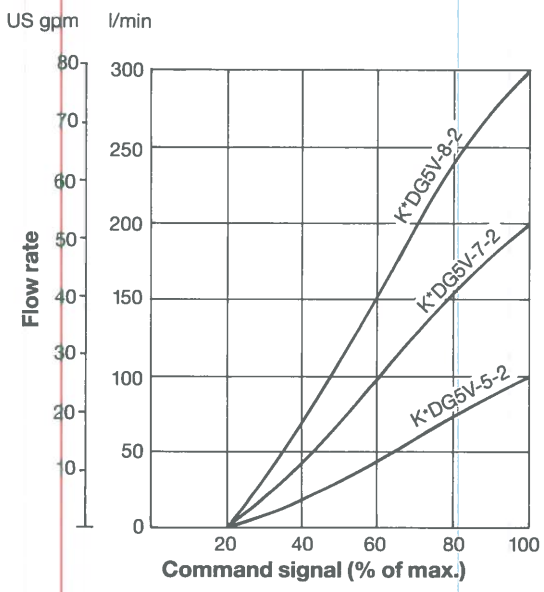
● **Flow gain**
At △p = 5 bar (72 psi) per metering path (e.g. P-A)■, with flow thru' P-A-B-T or P-B-A-T

■ At other △p values flow rates approximate to:

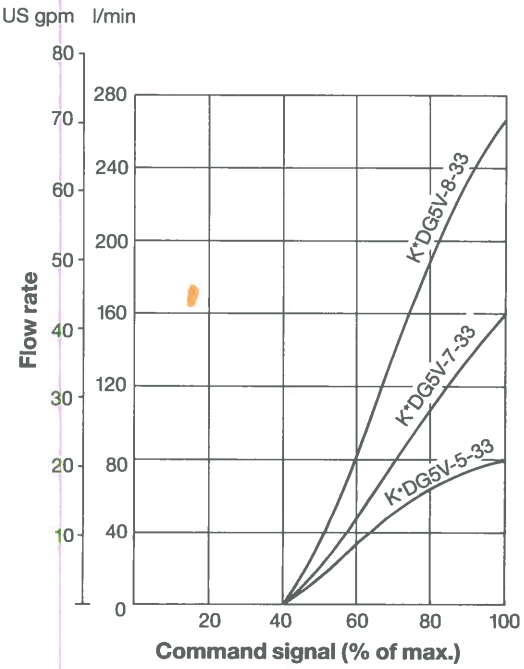
$$Q_x = Q_D \sqrt{\frac{\Delta p_x}{\Delta p_D}}$$

where $Q_D$ = Datum flow rate
$\Delta p_D$ = Pressure drop at datum flow rate
$\Delta p_x$ = Required △p

**K*DG5V-*-2C**

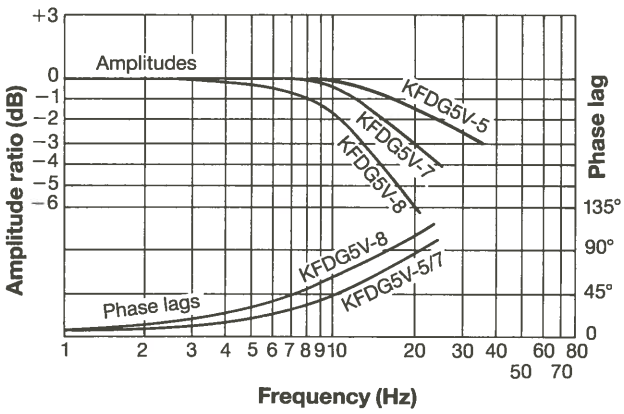



**K*DG5V-*-33C**

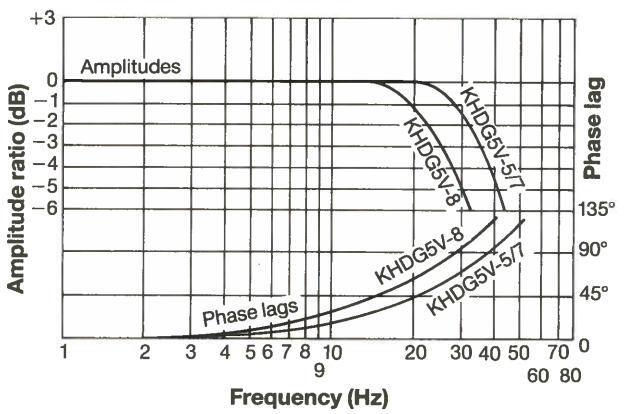


● **Frequency response**
For an amplitude of ±25% of max. stroke
(center-to-offset) about the 50% position

**KFDG5V-5/7/8**



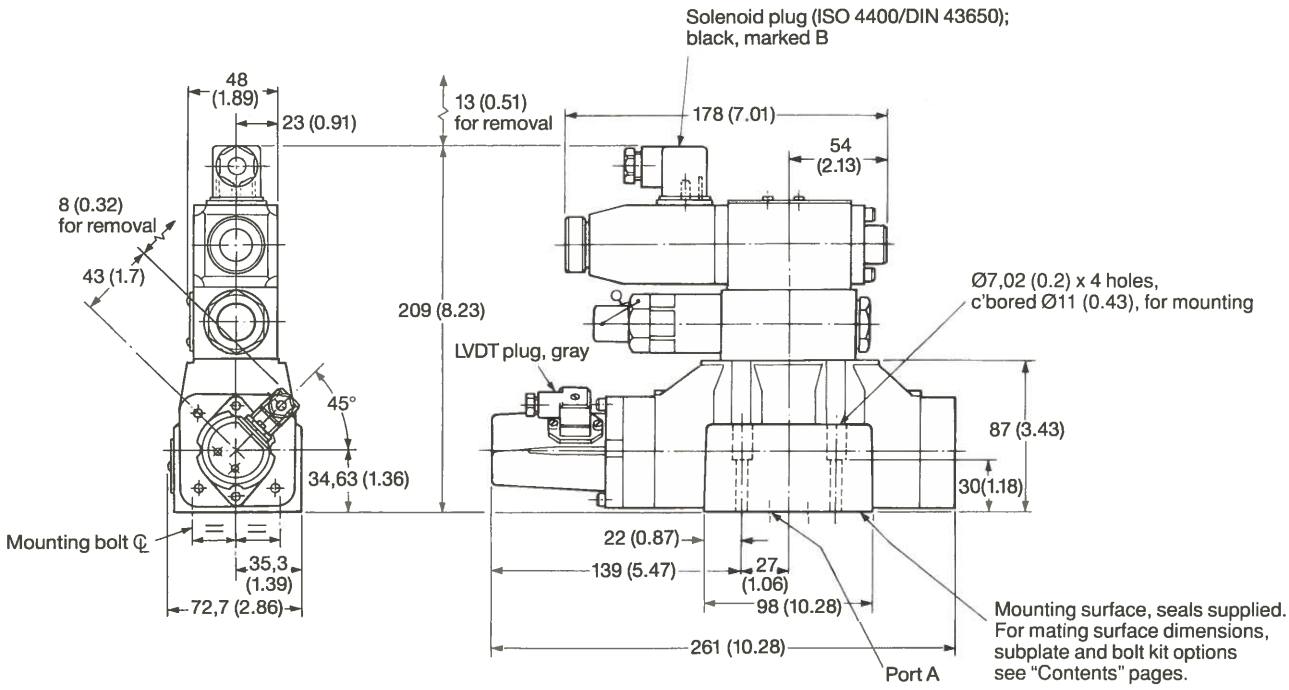

**KHDG5V-5/7/8**



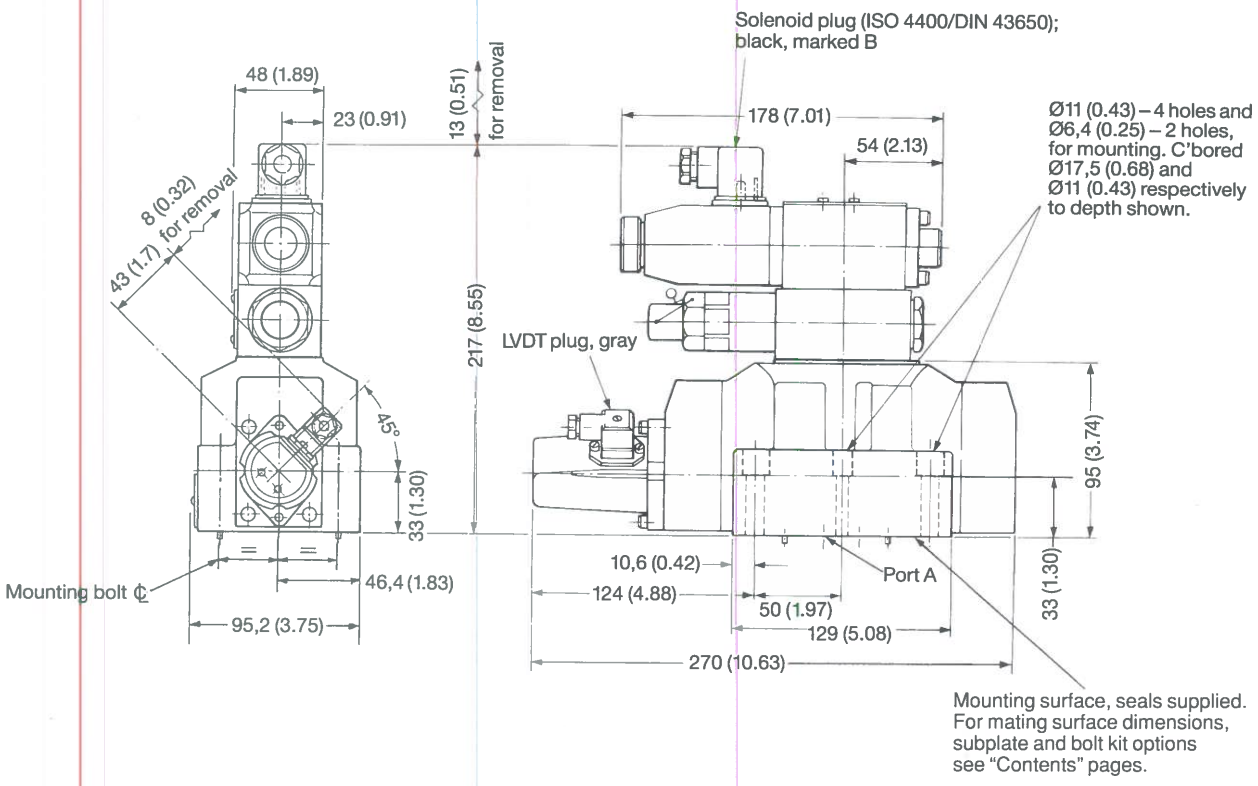

## 5. Installation dimensions in mm (inches)

3rd angle projection

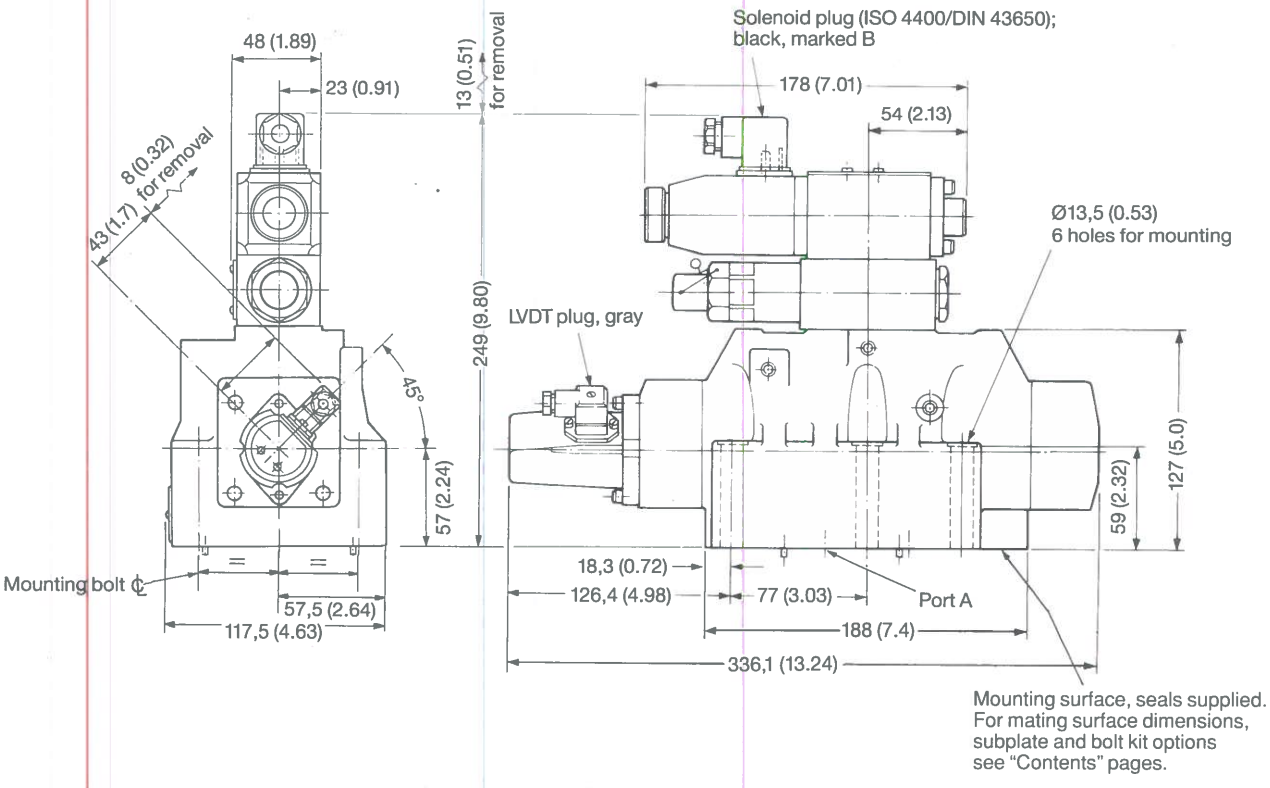
**KFDG5V-5**



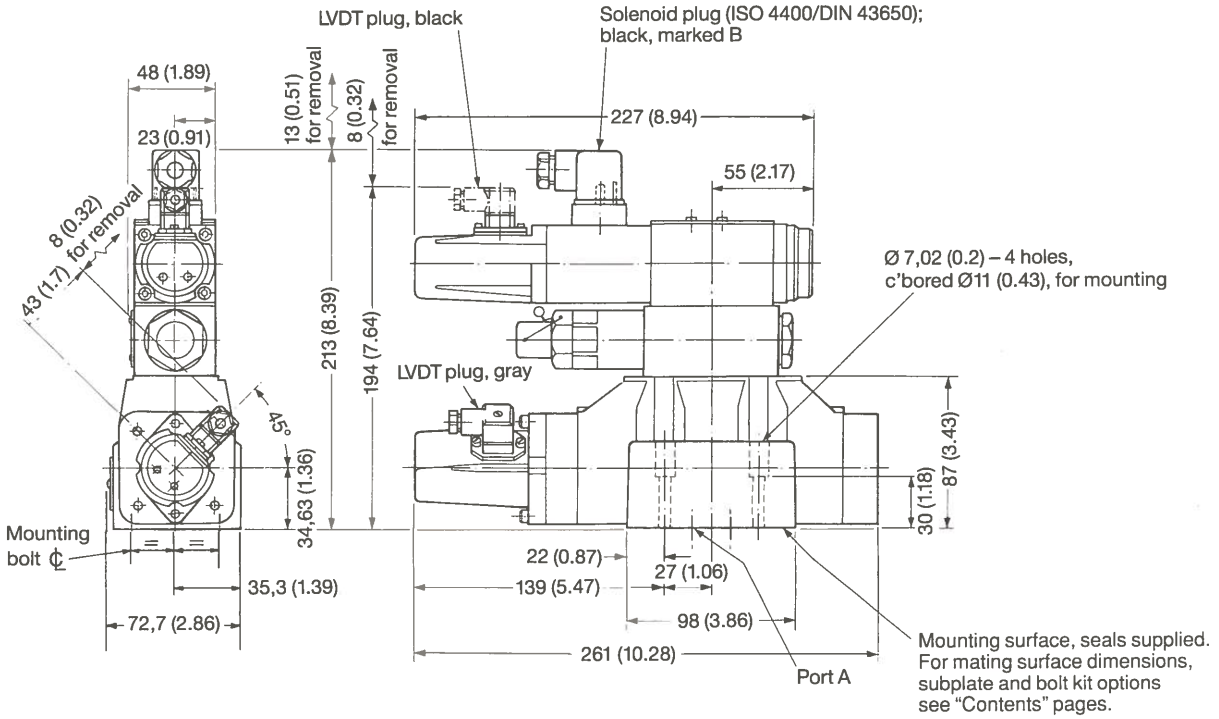
## KFDG5V-7



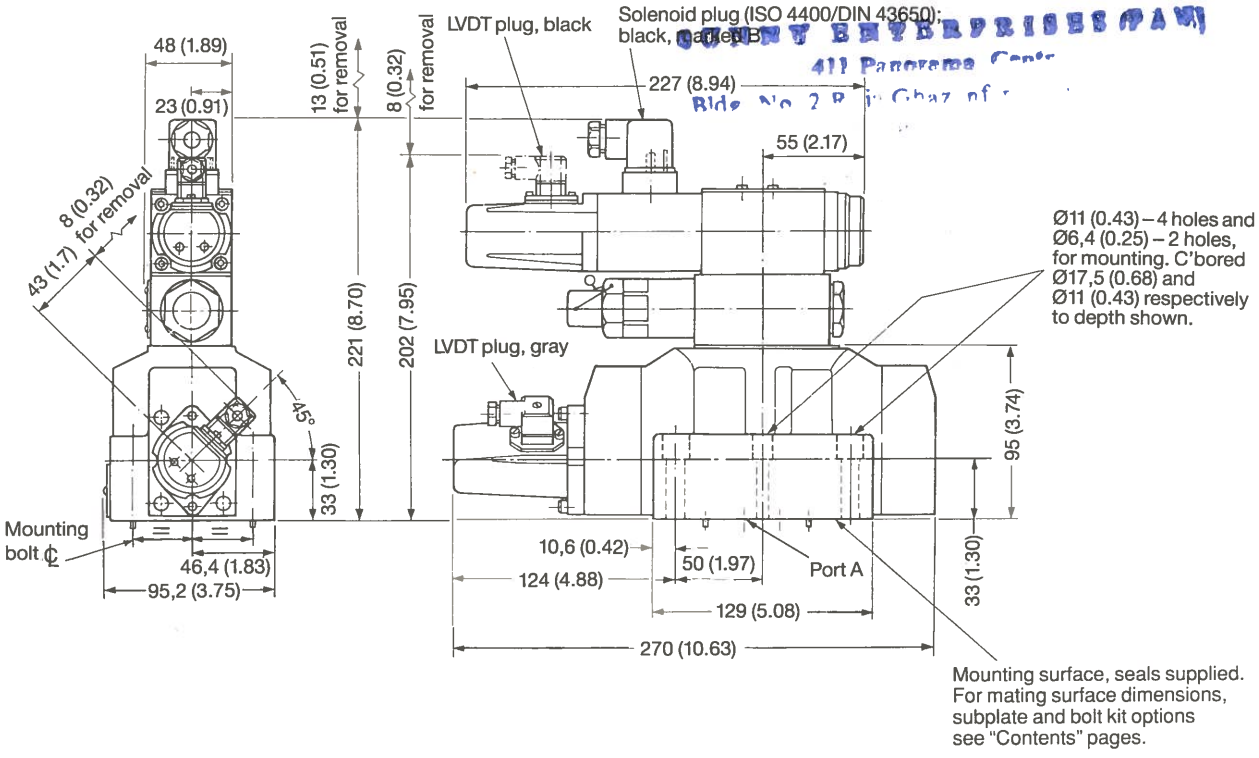

## KFDG5V-8



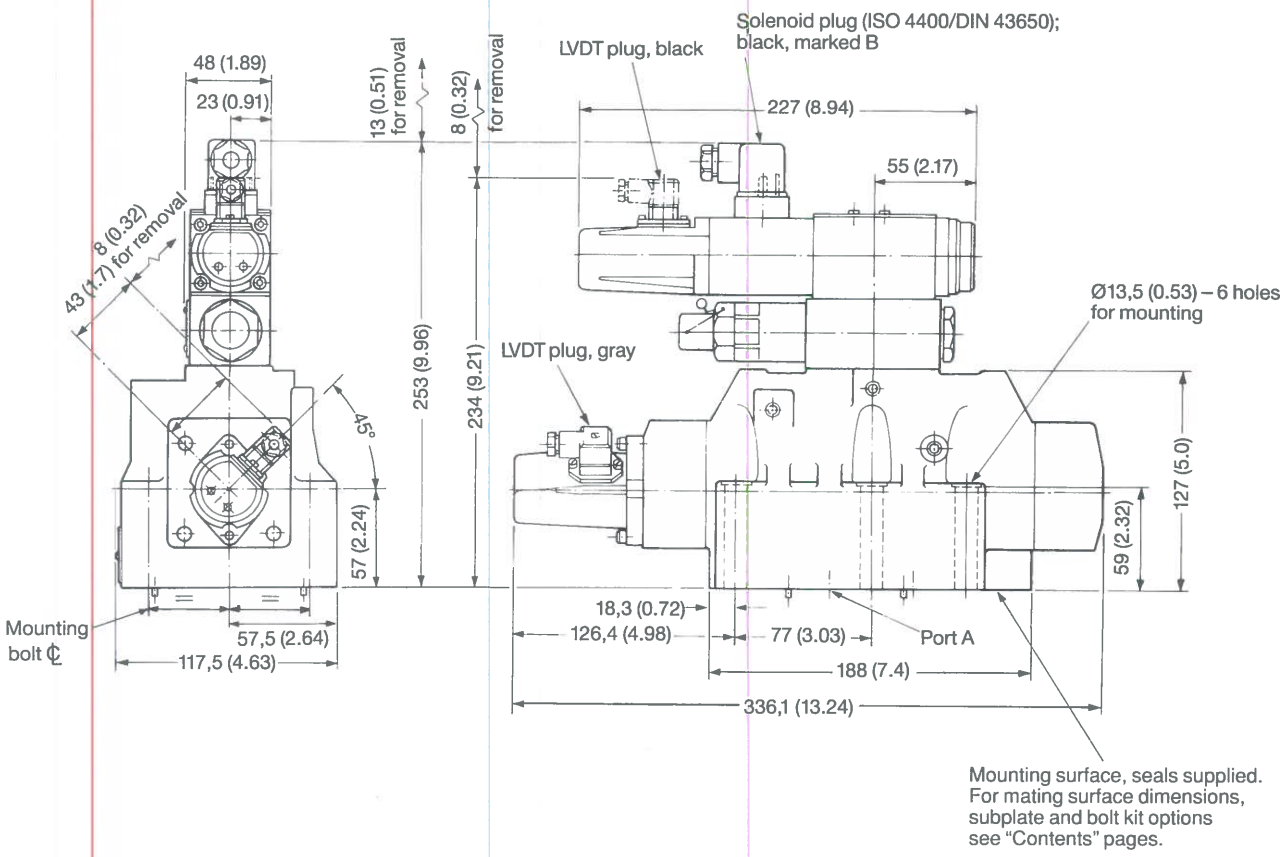
**KHDG5V-5**




**KHDG5V-7**



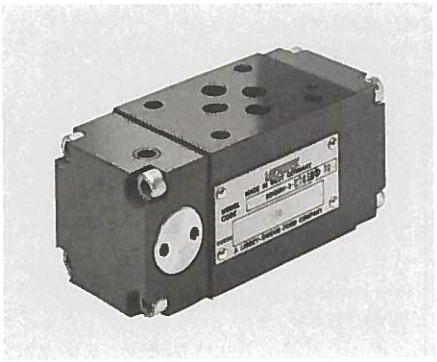
**KHDG5V-8**


48 (1.89)
23 (0.91)
13 (0.51) for removal
8 (0.32) for removal
Solenoid plug (ISO 4400/DIN 43650); black, marked B
LVDT plug, black
227 (8.94)
55 (2.17)
8 (0.32) for removal
43 (1.7)
Ø13,5 (0.53) – 6 holes for mounting
LVDT plug, gray
253 (9.96)
234 (9.21)
45°
57 (2.24)
59 (2.32)
127 (5.0)
18,3 (0.72)
126,4 (4.98)
77 (3.03)
Port A
188 (7.4)
336,1 (13.24)
Mounting bolt ℄
57,5 (2.64)
117,5 (4.63)
Mounting surface, seals supplied. For mating surface dimensions, subplate and bolt kit options see "Contents" pages.

# Hydrostat and pilot shuttle modules

KDGMH-3/5/7/8, 10 series hydrostat modules
DGMA-7/8, 10 series shuttle modules

ISO 4401 sizes 03, 05, 07 and 08



## 1. Functional symbols and application notes

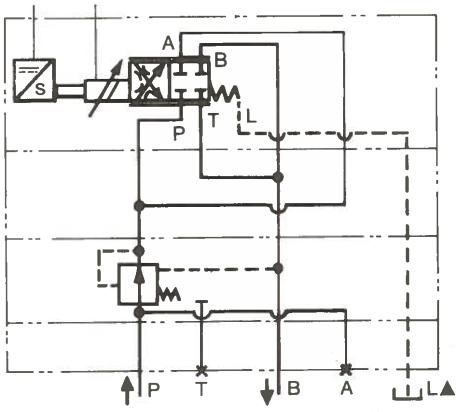
### K(F)TG4V-3/5 throttle valves●

Proportional throttle valve, typical

Parallel-flow-path module◪
KDGMA-3-616265 or
KDGMA-5-616877

Hydrostat module, P to P
KDGMH-3-616262,
KDGMH-5-616267 or
KDGMH-5-616824

Subplate◪



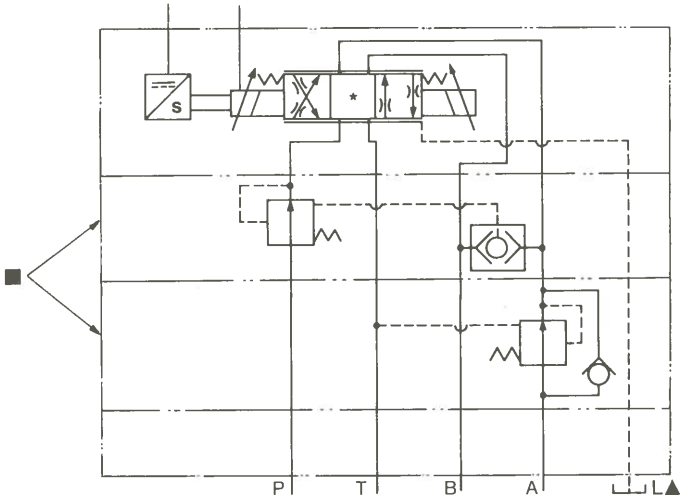

### K(F)DG4V-3/5 single-stage proportional valves●

Proportional directional valve, typical

Hydrostat module, P to A & B
KDGMH-3-616261,
KDGMH-5-616266 or
KDGMH-5-459062

Hydrostat module, A to T
KDGMH-3-616263

Subplate◪




● For details see "Contents" pages
▲ Not in K(F)*G4V-3 non-feedback proportional valves
■ Only one of these two types can be installed in any one stack
◪ For details see "Mounting surface, ... " in "Contents" pages

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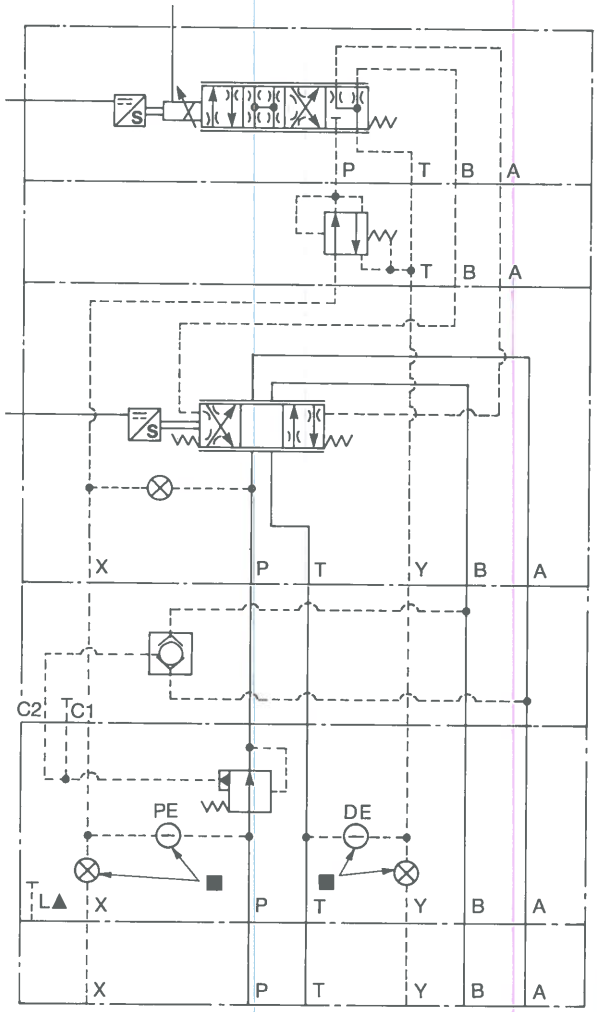
**K*DG5V-7/8 two-stage proportional valves●**




■ **Important**
Hydrostats supplied with plugs fitted in X and Y ports as ⊗. Before hydrostats are installed, re-locate plug(s) according to valve mode:
**For internal pilot/external drain mode**
Re-locate port Y plug to position DE
**For external pilot/external drain mode**
Re-locate port Y plug to position DE
Re-locate port X plug to position PE. See two pages on.

▲ Blind port, not used for applications described in this catalog
⊗ Plugged, as supplied. See ■
⊖ Unplugged, as supplied. See ■
◪ For details see "Mounting surface, ... " in "Contents" pages
● For details see "Contents" pages

## 2. Model codes

**For hydrostat modules**

**(F3-) KDGMH- * -******-1***
1 2 3 4

1 **Fluid compatibility**
Blank = Antiwear hydraulic oil
F3 = Phosphate esters or antiwear hydraulic oil

2 **Mounting size code (ISO 4401)**
3 = 03
5 = 05
7 = 07
8 = 08

3 **Function**
KDGMH-3-616261 = P to A or B control
KDGMH-3-616262 = P to P control
KDGMH-3-616263 = A to T control
KDGMH-5-459062 = P to A or B control
KDGMH-5-616266 = P to A or B control
KDGMH-5-616267 = P to P control
KDGMH-5-616824 = P to P control
KDGMH-7-616268 = P to A or B control
KDGMH-8-616269 = P to A or B control

Hydrostat flow ratings and control △p are detailed in "Max. pressures and flow ratings" on next page.

4 **Design number, 10 series◪**

**For pilot shuttle modules**

**DGMA- * -W- 1***
1 2

1 **Mounting size code (ISO 4401)**
7 = 07
8 = 08

2 **Design number, 10 series◪**

◪ Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.

## 3. Operating data

| | |
|---|---|
| Max. pressures | See table on next page |
| Flow rating | See table on next page |
| Hydraulic fluids ⬓: KDGMH hydrostats<br>DGMA shuttle modules | See 1 in "Model codes"<br>Antiwear hydraulic oil or phosphate esters |
| Temperature ranges and filtration recommendations | See "Contents" pages |
| Installation dimensions | See next page |
| Mass: KDGMH-3<br>KDGMH-5<br>KDGMH-7<br>KDGMH-8<br>DGMA-7<br>DGMA-8 | 1,1 kg (2.4 lb) approx.<br>6,2 kg (13.7 lb) approx.<br>16 kg (35.3 lb) approx.<br>30 kg (66.1 lb) approx.<br>4,1 kg (9.0 lb) approx.<br>5,6 kg (12.3 lb) approx. |
| Fastening kits | See "Contents" pages |

⬓ See also "Contents" pages.

● **Max. pressures and flow ratings**

| Model | Max. pressure, bar (psi) for ports: P, A & B | T | X | Y | L | Rated flow l/min (USgpm) | Datum Δp bar (psi) for rated flow |
|---|---|---|---|---|---|---|---|
| KDGMH-3-616261<br>KDGMH-3-616262<br>KDGMH-3-616263 | 315 (4567) | 210 (3000) | – | – | 10 (14.5) | 25 (6.6) | 8 (116) |
| KDGMH-5-616266<br>KDGMH-5-616267 | 315 (4567) | 210 (3000) | – | – | 2 (29) | 50 (13.2) | 4 (58) |
| KDGMH-5-459062<br>KDGMH-5-616824 | | | | | | 70 (18.5) | 8 (116) |
| KDGMH-7-616268 | 250 (3625) | 250 (3625) | 250 (3625) | 5 (72) | – | 180 (47.5) | 8 (116) |
| KDGMH-8-616269 | | | | | | 360 (95.0) | |
| DGMA-7-W | **Must** be placed between K*DG5V-7 directional valves and KDGMH-7-616268 hydrostat modules◪ | | | | | | |
| DGMA-8-W | **Must** be placed between K*DG5V-8 directional valves and KDGMH-7-616269 hydrostat modules◪ | | | | | | |

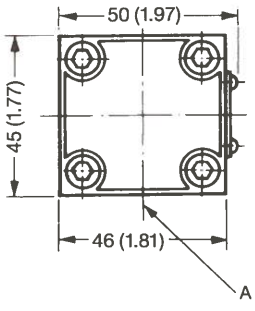
◪ If both of these are to be used together

## 4. Installation dimensions in mm (inches)

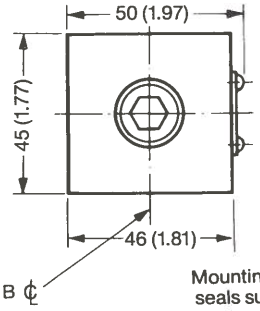
3rd angle projection

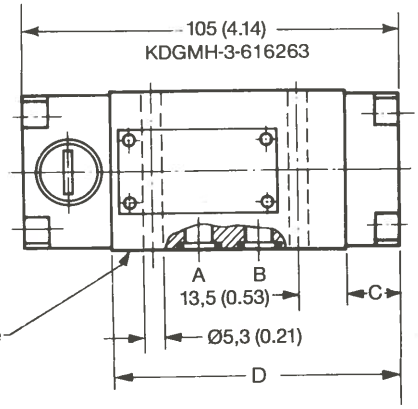
**KDGMH-3 hydrostat modules**

**KDGMH-3-616263**



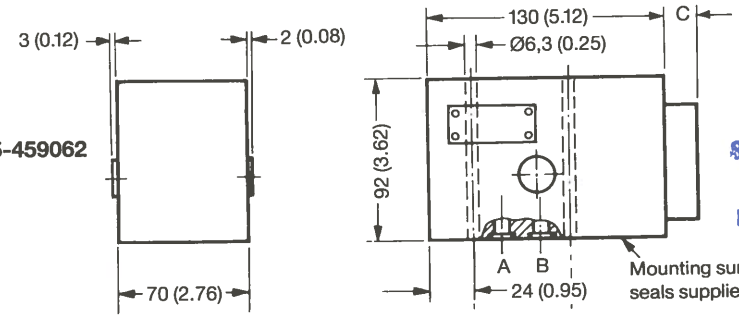

**KDGMH-3-616261 & 616262**



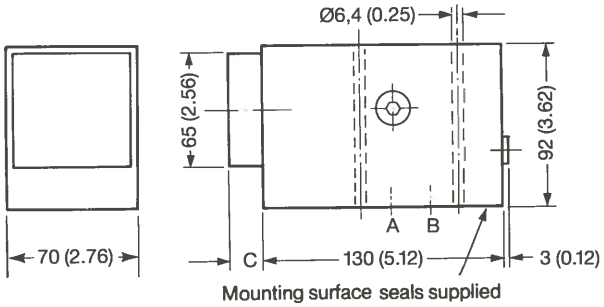




**KDGMH-5 hydrostat modules**

**KDGMH-5-459062 & 616266**




**KDGMH-5-616267 & 616824**




| Model | C | D |
|---|---|---|
| KDGMH-3-616261 | 15 (0.59) | 80 (3.15) |
| KDGMH-3-616262 | 22 (0.87) | 87 (3.43) |
| KDGMH-3-616263 | 15 (0.59) | 80 (3.15) |
| KDGMH-5-616266 | 21 (0.83) | – |
| KDGMH-5-616267 | 26 (1.03) | – |
| KDGMH-5-459062 | 26 (1.03) | – |
| KDGMH-5-616824 | 26 (1.03) | – |

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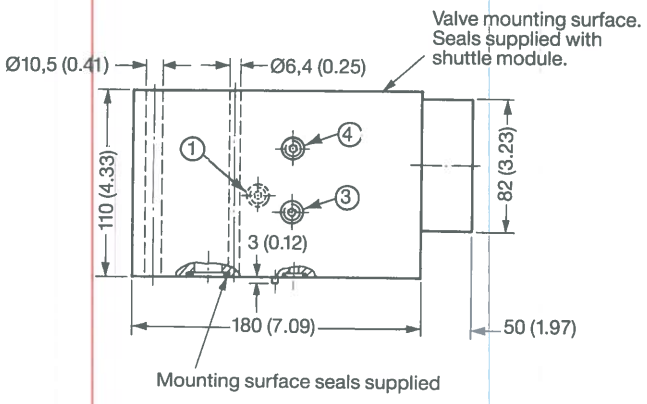
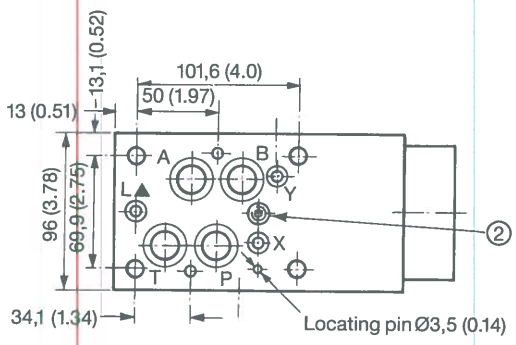
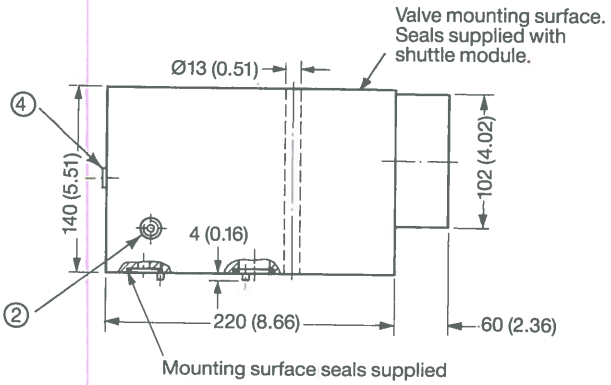
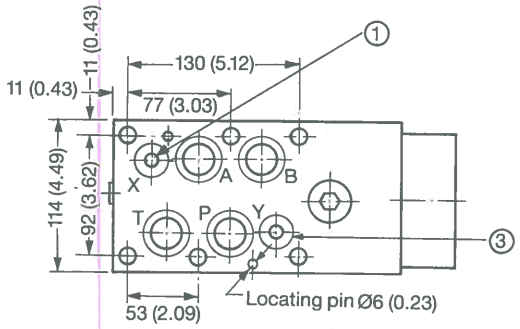
## KDGMH-7-616268 hydrostat module




## KDGMH-8-616269 hydrostat module




**Pilot pressure and drain conversions**
See "Important" note two pages back then re-locate plug(s) to suit required operating mode as below:

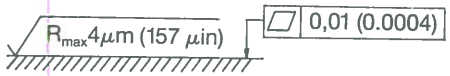
| Condition (△) Pilot pressure | Pilot drain | Plugs■ at locations Fitted | Omitted | | |
|---|---|---|---|---|---|
| As supplied | | ① | ③ | ② | ④ |
| Internal (P) | External (Y) | ① | ④ | ② | ③ |
| External (X) | External (Y) | ② | ④ | ① | ③ |

Operating modes

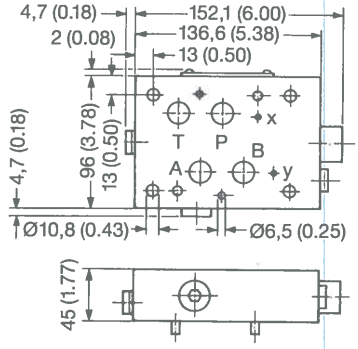
■ Hex. sockets in plugs for:
KDGMH-7 ..... 4 (0.155) A/F
KDGMH-8 ..... 5 (0.196) A/F
Torque to hand tightness

△ Effective port in main-stage mounting surface

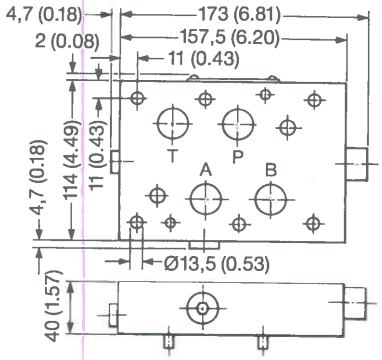
▲ Blind port




## DGMA-7-W pilot shuttle module




## DGMA-8-W pilot shuttle module



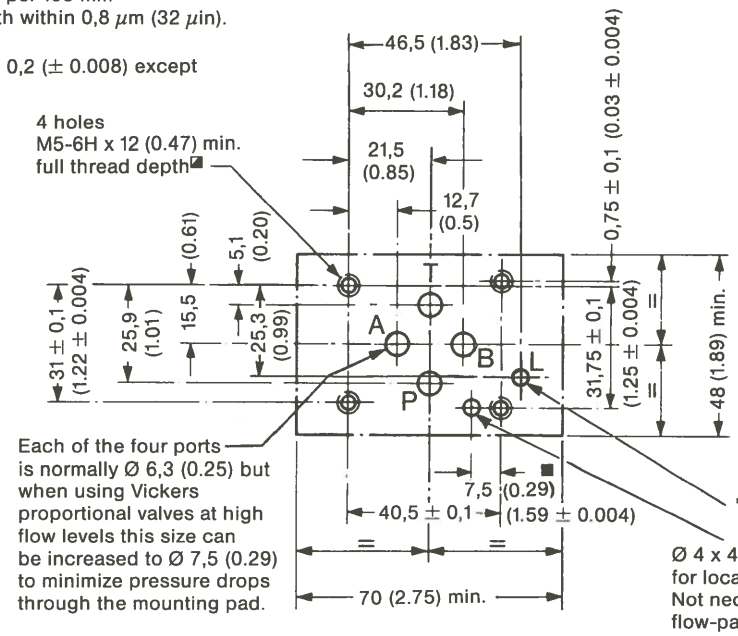
# Mounting surface, subplates and bolt kits

For proportional valves: KDG4V-3, KTG4V-3, KFDG4V-3, KFTG4V-3 and KSDG4V-3

## 1. Mounting surface dimensions in mm (inches)

When a subplate is not used, a machined pad must be provided for mounting; pad must be flat within 0,01 mm per 100 mm (0.0004" per 4") and smooth within 0,8 $\mu$m (32 $\mu$in).

Dimensional tolerance = ± 0,2 (± 0.008) except where otherwise stated.




◪ # 10-24 UNC-2B option, to meet ANSI/NFPA standard.

■ With inclusion of locating pin hole, surface also conforms to NFPA D01

● Required only when using KF*G4V-3 and KSDG4V-3 feedback valves under certain conditions: see "Max. pressures" tables in pages for these valves.

## 2. Operating data

| | |
|---|---|
| Valve mounting surface | ISO 4401-AB-03-4-A<br>Plus locating pin hole and drain port 'L'; see relevant notes above |
| Max. pressure | 350 bar (5075 psi) |
| Subplate dimensions | See drawings on next page |
| Mass:<br>DGVM-3<br>KDGMA-3<br>DGMS-3-1E<br>KDGVM-3 | <br>1,3 kg (2.9 lb) approx.<br>0,5 kg (1.10 lb) approx.<br>1,3 kg (2.9 lb) approx.<br>1,3 kg (2.9 lb) approx. |
| Bolt kits | See section 4 on next page |

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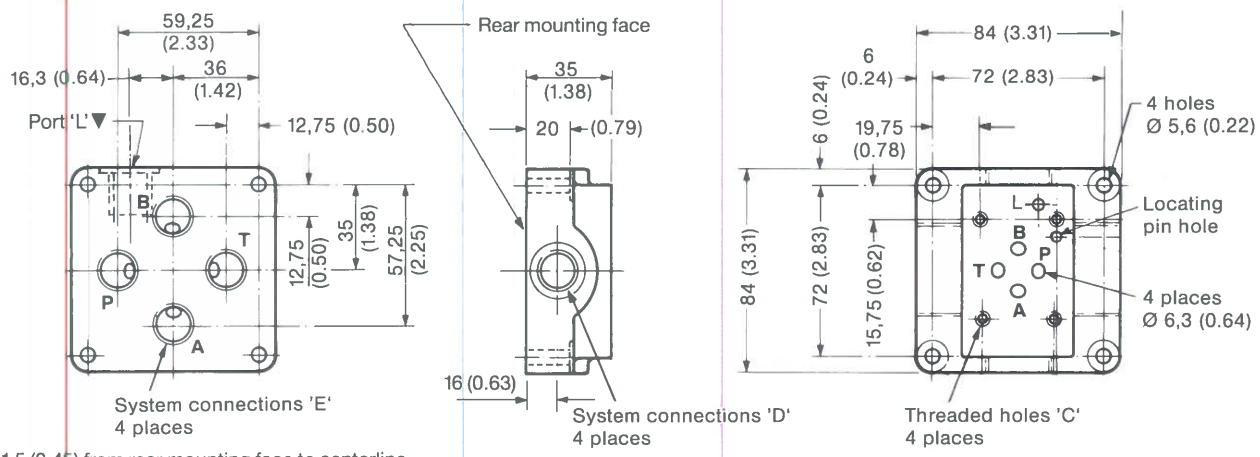
## 3. Subplate dimensions in mm (inches)

3rd angle projection

**Subplates**

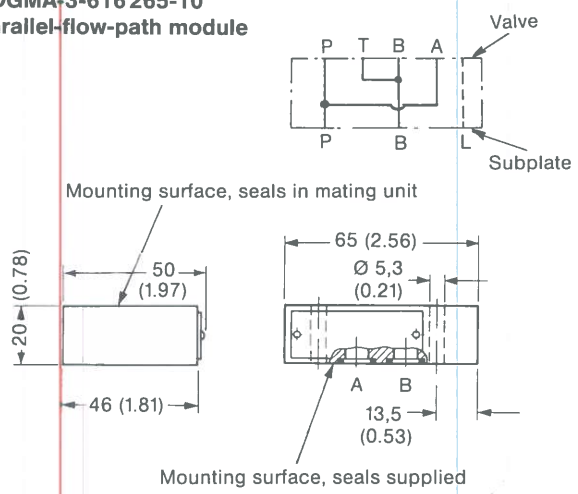



▼ 11,5 (0.45) from rear mounting face to centerline

| Model | C | D | E | L |
|---|---|---|---|---|
| DGVM-3-10-S | # 10 - 24 UNC-2B x 12,5 (0.5) full thread depth | — | 0.750″-16 UNF-2B▲ | — |
| KDGVM-3-676803-10 | | | | 0.437″-20 UNF-2B● |
| DGMS-3-1E-10-S | | 0.750″-16 UNF-2B▲ | — | — |
| DGMS-3-1EY-10-S | | 0.562″-18 UNF-2B◪ | — | — |
| DGVM-3-11-R□ | M5-6H x 12 (0.47) full thread depth | — | G3/8″■ | — |
| KDGVM-3-11-R□ | | | | G1/8″■ |
| DGMS-3-1E-11-R□ | | G3/8″■ | — | — |

▲ 14,3 (0.56) full thread depth
● 11,6 (0.45) full thread depth
◪ 12,7 (0.50) full thread depth
■ 12 (0.47) full thread depth
□ 11 and later designs essential for use with feedback valves

**KDGMA-3-616265-10 parallel-flow-path module**




Recommended bolt torque 7-9 Nm (62-79 lbf in).
If bolts are provided by user they must be to ISO 898 class 12.9 (SAE grade 7) or equivalent.

## 4. Fixing kits

Mounting the various combinations of modules and valves in one stack will require bolts of different lengths.
They can be assessed using values from table 1 plus a 10 mm (0.4 in) allowance for thread engagement in the subplate. Select bolt kit from table 2.

**Table 1: Effective bolt lengths**

| Model | Length, mm (in) |
|---|---|
| KDG4V-3 directional valve<br>KFDG4V-3 directional valve<br>KTG4V-3 throttle valve<br>KFTG4V-3 throttle valve | 21 (0.83) |
| KDGMA-3-616265 parallel-flow-path module | 20 (0.79) |
| KDGMH-3 hydrostat module | 45 (1.77) |

Where using other valves ascertain their effective bolt lengths.

**Table 2: Bolt kits**

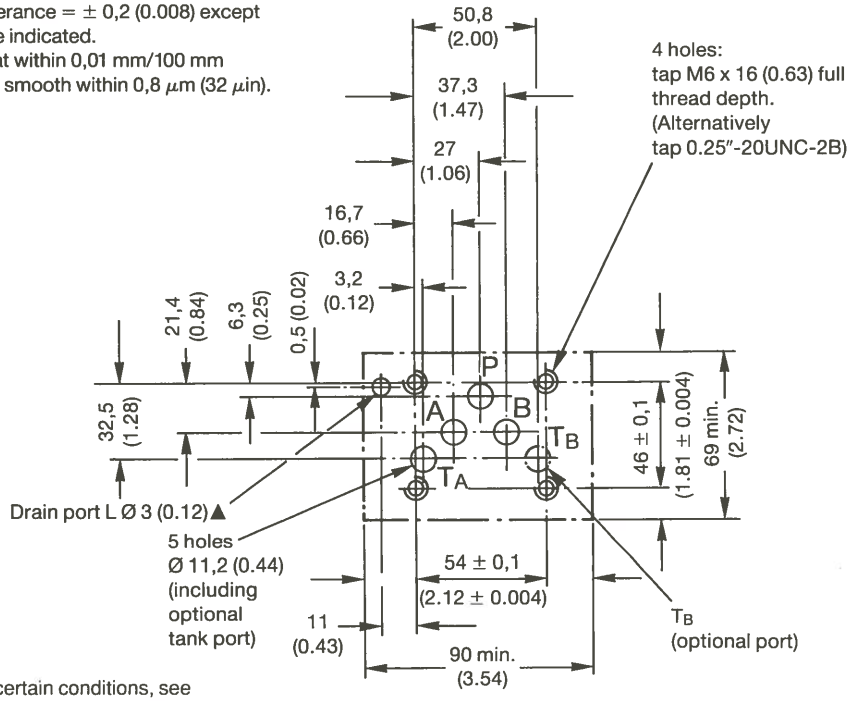
| Bolt kit, M5-6H thread | Bolt length, mm (inches) | Bolt kit, # 10-24 UNC | Bolt length, mm (inches) |
|---|---|---|---|
| BK616452 | 30 (1.18) | BK59016 | 31,8 (1.25) |
| BK466835M | 50 (1.97) | BKDG3698 | 50,8 (2.0) |
| BK464125M | 70 (2.76) | BKDGFNL694 | 69,9 (2.75) |
| BK869720M | 75 (2.95) | BK869703 | 76,2 (3.00) |
| BK466837M | 80 (3.15) | BK466850 | 79,4 (3.125) |
| BK466838M | 90 (3.54) | BK466851 | 88,9 (3.50) |
| BK869721M | 95 (3.74) | BK869704 | 95,3 (3.75) |
| BK466839M | 100 (3.94) | BK466852 | 100,0 (3.94) |
| BK466840M | 110 (4.33) | — | — |

# Mounting surface, subplates and bolt kits

For proportional valves: KDG4V-5, KTG4V-5, KFDG4V-5, KFTG4V-5, KFDG5V-5 and KHDG5V-5

## 1. Mounting surface dimensions in mm (inches)

When a subplate is not used, a raised machined pad must be provided for mounting.
Dimensional tolerance = ± 0,2 (0.008) except where otherwise indicated.
Surface to be flat within 0,01 mm/100 mm (0.0004"/4") and smooth within 0,8 μm (32 μin).




▲ Required under certain conditions, see "Max. pressures" tables for KDG4V-5, KTG4V-5, KFDG4V-5 and KFTG4V-5 valves.
K*DG5V-5 valves may instead require pilot ports X and Y as shown three pages on for the DGAM-5 adaptor.

## 2. Operating data

| | |
|---|---|
| Valve mounting surface | ISO 4401-AC-05-4-A<br>plus optional drain port L■ |
| Max. pressure: | |
| DGAM-5 adaptor module | 210 bar (3000 psi) |
| DGSM(E)-01 subplates | 210 bar (3000 psi) |
| EDGSM-01(*) subplates | 280 bar (4060 psi) |
| EDGSM-03(X) subplates | 210 bar (3000 psi) |
| EKDGSM-01Y subplates | 280 bar (4060 psi) |
| KDGMA-5-616877 parallel-flow path module | 250 bar (3625 psi) |
| KDGSM-5-615225/615226 subplates | 315 bar (4567 psi) |
| KDGSM-5-676805 subplate | 210 bar (3000 psi) |
| Bolt and stud kits | 315 bar (4567 psi) |
| Subplate dimensions and model codes | See next three pages |
| Mass: | |
| DGAM-5 | 1,4 kg (3.1 lb) approx. |
| DGSM(E)-01 | 2,0 kg (4.4 lb) approx. |
| EDGSM-01(*) | 2,0 kg (4.4 lb) approx. |
| EDGSM-03(X) | 5,0 kg (11.0 lb) approx. |
| EKDGSM-01Y | 2,0 kg (4.4 lb) approx. |
| KDGMA-5-616877 | 1,5 kg (3.3 lb) approx. |
| KDGSM-5-615225/615226 | 3,0 kg (6.6 lb) approx. |
| KDGSM-5-676805 | 2,0 kg (4.4 lb) approx. |
| Bolt and stud kits | See section 4 three pages on |

■ Pilot and drain ports X & Y for K*DG5V valves available in DGAM-5 adaptor module

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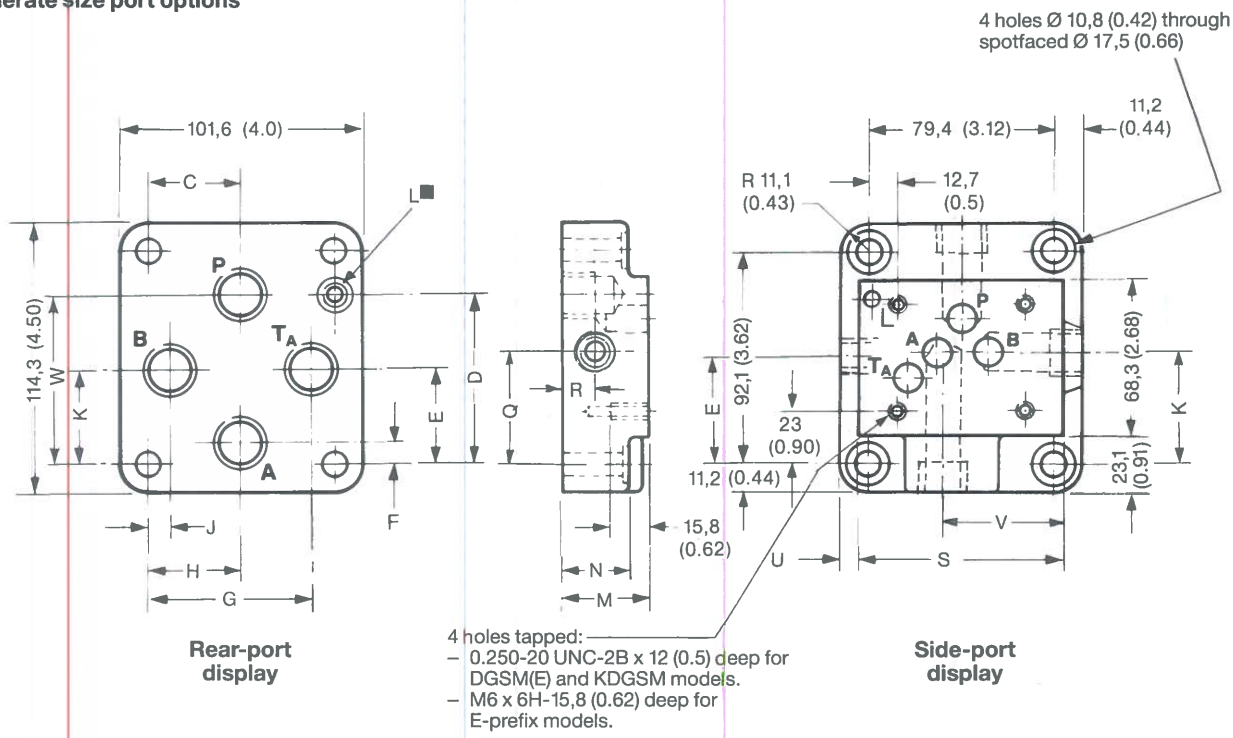
## 3. Subplate dimensions in mm (inches)

3rd angle projection

**Subplates for K(F)*G4V-5 single-stage proportional valves**
**Moderate size port options**




**Rear-port display**

**Side-port display**

| Model | Ports at: | Max. pressure bar (psi) | Ports P, A, B & T | Port L■ | C | D | E |
|---|---|---|---|---|---|---|---|
| DGSM-01-2*-T8 | Rear | 210 (3000) | 0.750"-16UNF-2B x 14,3 (0.56) full thread | — | 45,2 (1.78) | 68,3 (2.69) | 42,1 (1.66) |
| DGSME-01-2*-T8 | Side | | | — | 39,6 (1.56) | — | 37,3 (1.47) |
| KDGSM-5-676805-2* | Rear | | | 0.5625"-18UNF-2B x 12,7 (0.5) full thread | 45,2 (1.78) | 68,3 (2.69) | 42,1 (1.66) |
| EDGSM-01-1*-R | Rear | 280 (4060) | G¼" x 12,2 (0.48) full thread | — | 39,7 (1.56) | 62,7 (2.47) | 38,1 (1.5) |
| EDGSM-01X-1*-R | Rear | | G⅜" x 12,2 (0.48) full thread | | | 68,6 (2.70) | 40,5 (1.59) |
| EDGSM-01Y-1*-R | Rear | | G½" x 15 (0.59) full thread | | | 72,6 (2.86) | |
| EKDGSM-01Y-1*-R | Rear▲ | | | G⅛" x 12 (0.47) full thread | | | |

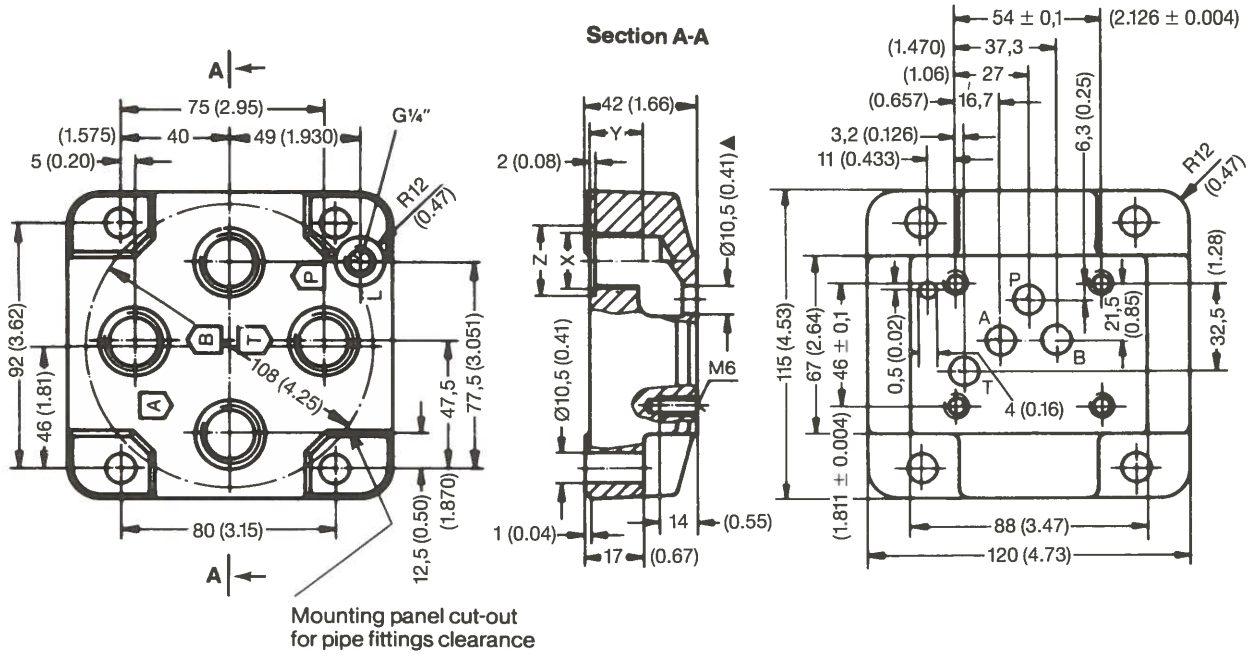
| Model | Ports at: | F | G | H | J | K | M |
|---|---|---|---|---|---|---|---|
| DGSM-01-2*-T8 | Rear | 19 (0.75) | 68,3 (2.69) | 45,2 (1.78) | 23,8 (0.94) | 42,1 (1.66) | 31,8 (1.25) |
| DGSME-01-2*-T8 | Side | — | — | — | — | 47,7 (1.88) | 38,1 (1.50) |
| KDGSM-5-676805-2* | Rear | 19 (0.75) | 68,3 (2.69) | 45,2 (1.78) | 23,8 (0.94) | 42,1 (1.66) | 31,8 (1.25) |
| EDGSM-01-1*-R | Rear | 13,5 (0.53) | 65,5 (2.58) | 41,7 (1.64) | 10,3 (0.41) | 40,9 (1.61) | 31,8 (1.25) |
| EDGSM-01X-1*-R | Rear | | 67,5 (2.66) | 39,7 (1.56) | 12,7 (0.50) | 40,5 (1.59) | |
| EDGSM-01Y-1*-R | Rear | 9,9 (0.39) | 70,6 (2.78) | | 10,7 (0.42) | | |
| EKDGSM-01Y-1*-R | Rear▲ | | | | | | 36,5 (1.44) |

| Model | Ports at: | N | Q | R | S | U | V | W |
|---|---|---|---|---|---|---|---|---|
| DGSM-01-2*-T8 | Rear | 23,9 (0.94) | — | — | 90,4 (3.56) | 5,6 (0.22) | — | 57,15 (2.25) |
| DGSME-01-2*-T8 | Side | | 47,7 (1.88) | 18,3 (0.72) | 101,6 (4.0) | — | 46,2 (1.82) | — |
| KDGSM-5-676805-2* | Rear | | — | — | 90,4 (3.56) | 5,6 (0.22) | — | 57,15 (2.25) |
| EDGSM-01-1*-R | Rear | | | | | | | 62,7 (2.47) |
| EDGSM-01X-1*-R | Rear | | | | | | | 68,6 (2.70) |
| EDGSM-01Y-1*-R | Rear | 28,6 (1.13) | | | | | | 72,6 (2.86) |
| EKDGSM-01Y-1*-R | Rear▲ | | 47,5 (1.87)▲ | 23,8 (0.94)▲ | | | | |

▲ Port L side entry

**Subplates for K(F)*G4V-5 single-stage proportional valves.**
**Large size port options.**

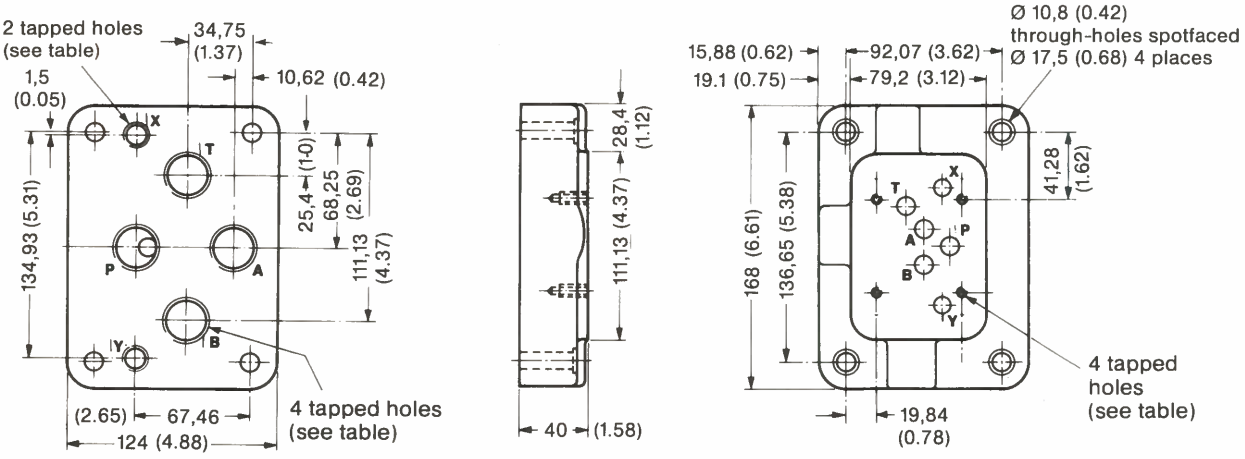
KDGSM-5 subplates with drain L




| Model | X | Y | ØZ |
|---|---|---|---|
| KDGSM-5-615225-10 | G½" | 14 (0.55) | 30 (1.18) |
| KDGSM-5-615226-10 | G¾" | 16 (0.63) | 33 (1.30) |

▲Max. diameter of ports

**Subplates for K*DG5V-5 two-stage proportional valves**




| Model code | Mounting bolt tappings | Ports A, B, P and T | Ports X and Y |
|---|---|---|---|
| EDGSM-03-1* -R | M6-6H x 16 (0.62) full thread | G½" (BSPF) | G¼" (BSPF) |
| EDGSM-03X-1* -R | M6-6H x 16 (0.62) full thread | G¾" (BSPF) | G¼" (BSPF) |

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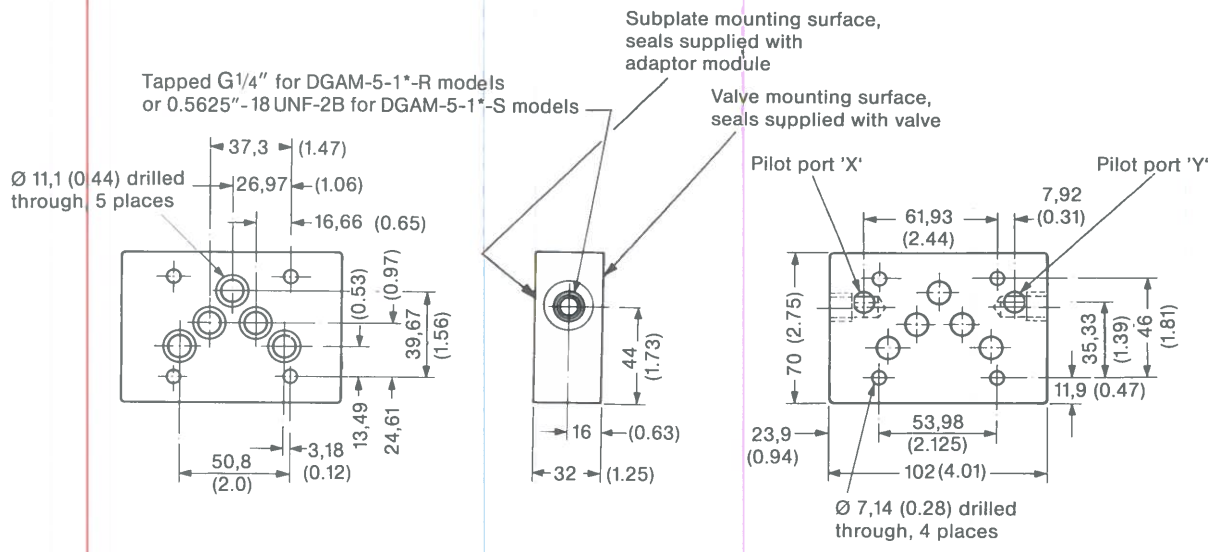
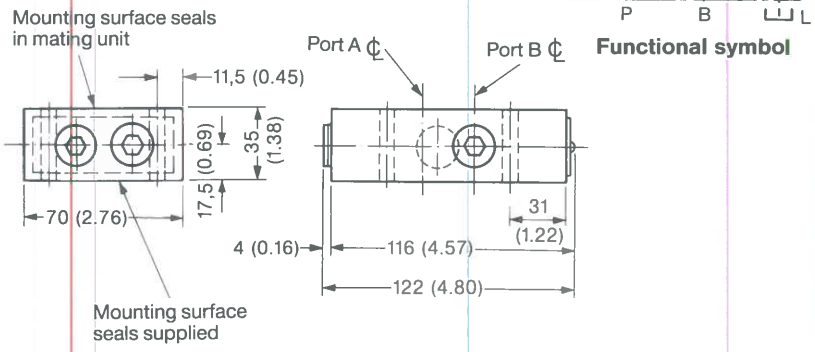
**DGAM-5 pilot ports adaptor module for K*DG5V-5 two-stage proportional valves. Allows external connections to pilot ports**




**KDGMA-5-616877-1* parallel-flow-path module, for use with K(F)TG4V-5 proportional valves**




**Selection of fixing bolt or stud kits**
Determine the fixing kit for a module stack by the following steps:
1. Total the effective lengths of the stack components, taken from table 1.
2. Select related fixing kit from table 2.

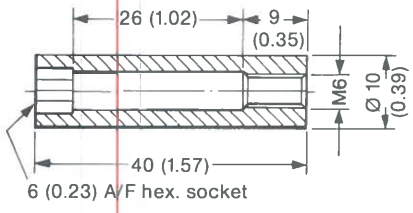
**Table 1. Effective bolt or stud length in valves and modules**

| Model | Length mm (in) |
|---|---|
| Proportional valves | |
| K(F)*G4V-5 | 30 (1.18) |
| K*DG5V-5 | 30 (1.18) |
| Modules | |
| DGAM-5 | 32 (1.26) |
| KDGMA-5 | 35 (1.38) |
| KDGMH-5 | 92 (3.62) |

## 4. Fixing kits

Bolt or stud kits are required to fix modular valve stacks to the mounting subplate or pad. Their lengths vary according to the height of the stack, which must not exceed 245 (9.65).

Bolts are used for the shorter heights and studs for the taller stacks, as indicated in table 2. Metric stud kits include special nuts, as shown here:




These nuts are designed for use with high stacks topped by Vickers range of ISO 4401 size 05 proportional valves.

**Table 2. Fixing kits**

| Effective stack height mm (inches) | Fixing kit, metric | | | Fixing kit, inch | | |
|---|---|---|---|---|---|---|
| | Number | Bolts or studs | Length mm (inches) | Number | Bolts or studs | Length mm (inches) |
| 30 (1.18) | BK534569 | B | 45 (1.77) | BK534549 | B | 44,4 (1.75) |
| 62 (2.44) | BK534574 | B | 75 (2.95) | BK534554 | B | 76,2 (3.0) |
| 65 (2.56) | BK534574 | B | 75 (2.95) | BK534554 | B | 76,2 (3.0) |
| 122 (4.80) | BK978457 | S | 146 (5.75) | BK565518 | B | 133,3 (5.25) |
| 157 (6.18) | BK978459 | S | 183 (7.2) | BK565519 | B | 171,4 (6.75) |

**Note** - Fixing kits provided by customers should be of steel to ISO 898 class 14.9 or stronger.

**Recommended torque, lubricated**
14 Nm (10.3 lbf ft) for pressures up to 210 bar (3000 psi), 20 Nm (14.75 lbf ft) for pressures between 210 bar (3000 psi) and 315 bar (4567 psi).

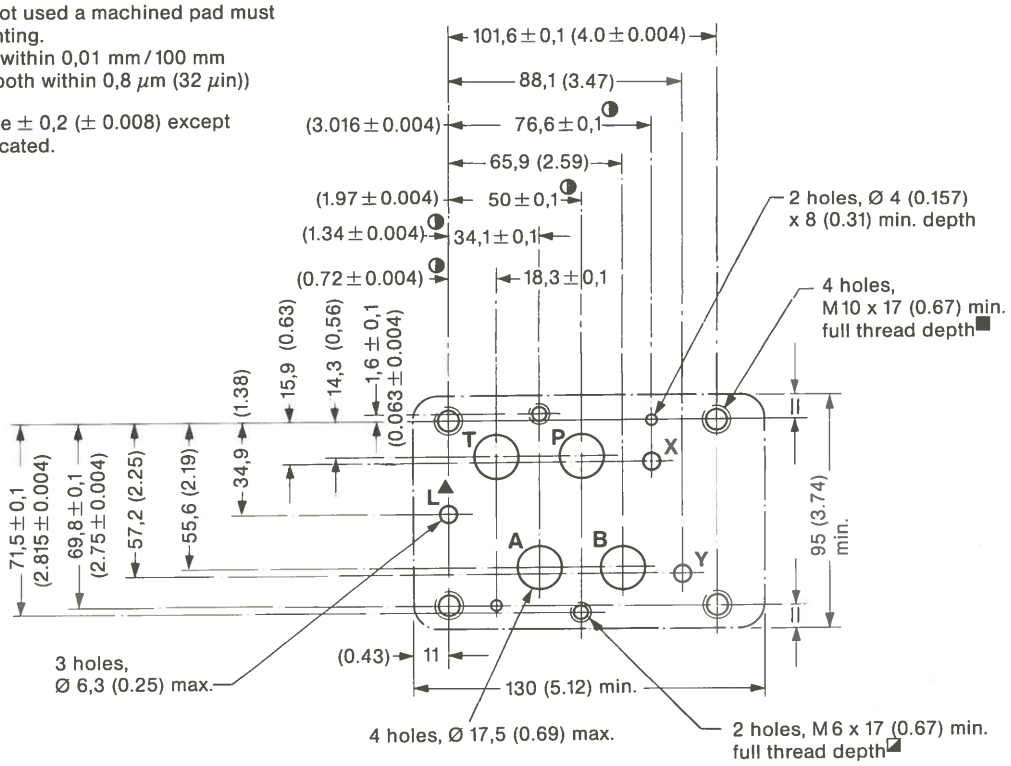
# Mounting surface, subplates and bolt kits

For proportional valves: KFDG5V-7 and KHDG5V-7

## 1. Mounting surface dimensions in mm (inches)

When a subplate is not used a machined pad must be provided for mounting.
The pad must be flat within 0,01 mm / 100 mm (0.0004"/4") and smooth within 0,8 µm (32 µin))

Dimensional tolerance ± 0,2 (± 0.008) except where otherwise indicated.




▲ Not required for valves in this catalog

■ 0.375"-16UNC option to meet ANSI/NFPA standards

◪ 0.250"-20UNC option to meet ANSI/NFPA standards

◑ Tolerance for location of ports T, A, P and X can be ± 0,2 (± 0,008 ).

## 2. Operating data

| | |
|---|---|
| Valve mounting surface | ISO 4401-AD-07-4-A |
| Max. pressure | 350 bar (5075 psi)⬓ |
| Subplate dimensions | See next page |
| Subplate mass:<br>DGSM-04<br>EDGVM-7-X<br>EDGVM-7-Y | <br>3,8 kg (1.73 lb) approx.<br>3,8 kg (1.73 lb) approx.<br>6,1 kg (2.77 lb) approx. |
| Bolt kits | See two pages on |

⬓ EDGVM models only. 210 bar (3000 psi) for DGSM models.

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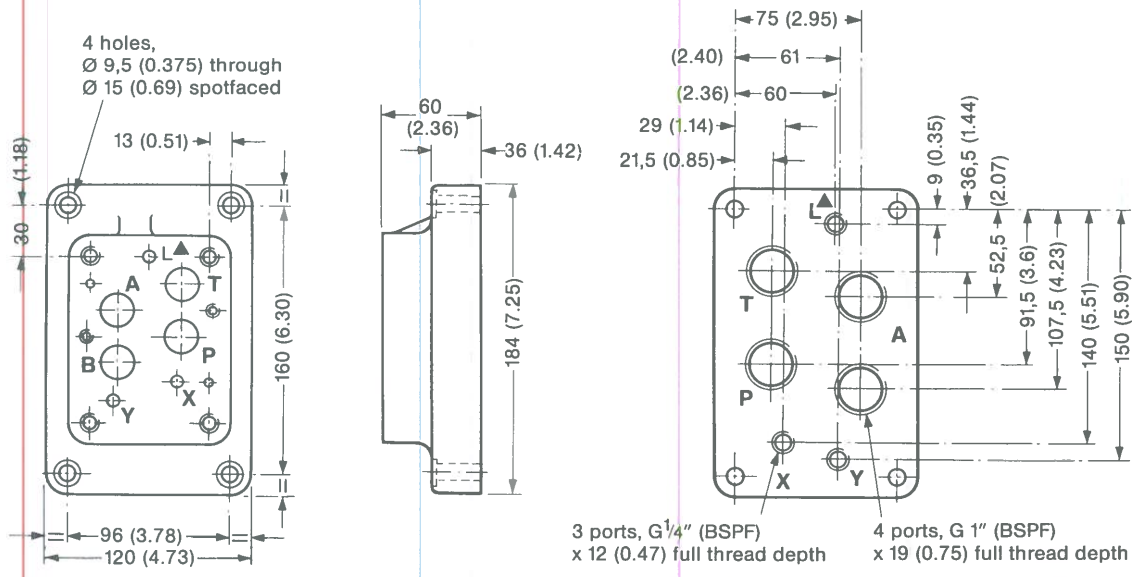
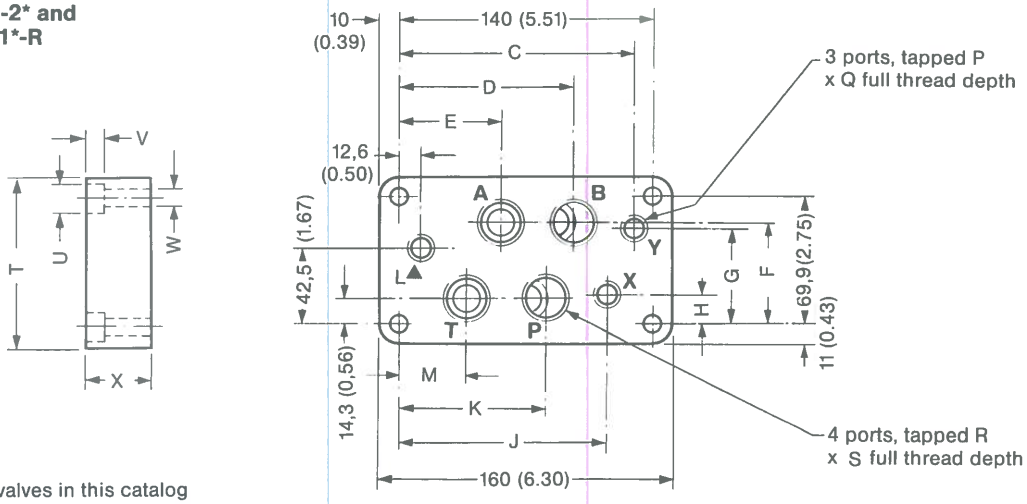
## 3. Subplate dimensions in mm (inches)

3rd angle projection

**EDGVM-7Y-D-1*-R**




**DGSM-04-12S-2* and**
**EDGVM-7X-D-1*-R**




▲ Not used with valves in this catalog

| Model | C | D | E | F | G | H | J | K | M | P |
|---|---|---|---|---|---|---|---|---|---|---|
| DGSM-04-12S-2* | 121,4 (4.78) | 88,4 (3.48) | 44,2 (1.74) | 56,6 (2.23) | 54,9 (2.16) | 18,3 (0.72) | 121,4 (4.78) | 76,7 (3.02) | 32,3 (1.27) | 0.5625" -18UNF-2B |
| EDGVM-7X-D-1*-R | 128,6 (5.06) | 93,6 (3.68) | 50,6 (1.99) | 55,6 (2.19) | 52 (2.05) | 15,9 (0.63) | 113,6 (4.47) | 79,6 (3.13) | 36,6 (1.44) | G1/4" |

| Model | Q | R | S | T | Ø U | V | Ø W | X |
|---|---|---|---|---|---|---|---|---|
| DGSM-04-12S-2* | 12,7 (0.50) | 1.0625" -12UNF-2B | 19,1 (0.75) | 89 (3.5) | – | – | 8,73 (0.344) | 38,1 (1.50) |
| EDGVM-7X-D-1*-R | 12 (0.47) | G3/4" | 16 (0.63) | 92 (3.62) | 14,5 (0.57) | 10 (0.39) | 9,9 (0.389) | 35 (1.38) |

## 4. Fixing kits

A bolt or stud kit is required to fix a valve stack on a mounting subplate or pad. Bolt/stud lengths vary according to the effective height of the stack.

Selection of fixing kit

1. Total the effective bolt lengths of the stack components (see table 1) to arrive at the effective stack height.
2. Select the related kit from table 2.

**Table 1. Effective bolt lengths of modules and directional valves**

| Model | Length mm (inches) |
|---|---|
| K*DG5V-7 proportional valve | 33 (1.30) |
| DGMA-7 shuttle adaptor<br>KDGMH-7 hydrostat | 155 (6.10) |

**Table 2. Effective stack height and bolt kits**

| Stack height mm (inches) | Bolt kit (ISO 898 Grade 12.9) Metric▲ | Length mm (inches) | UNC◪ | Length mm (inches) |
|---|---|---|---|---|
| 33 (1.30) | BKDG7-858918 | 45 (1.77) | BK590724 | 44,5 (1.75) |
| 188 (7.40) | BKDG7-858919 | 200 (7.89) | BK590725 | 203 (8.0) |

▲ Comprises: — Torque (lubricated) to:
- 4 x M10 bolts ..... 49 - 59 Nm (36 - 43 lbf ft)
- 2 x M6 bolts ..... 9 - 14 Nm (6.6 - 10.3 lbf ft)

◪ Comprises: — Torque (lubricated) to:
- 4 x 0.375"-16UNC-2B bolts ..... 49 - 59 Nm (36 - 43 lbf ft)
- 2 x 0.250"-20UNC-2B bolts ..... 9 - 14 Nm (6.6 - 10.3 lbf ft)

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# Mounting surface, subplates and bolt kits

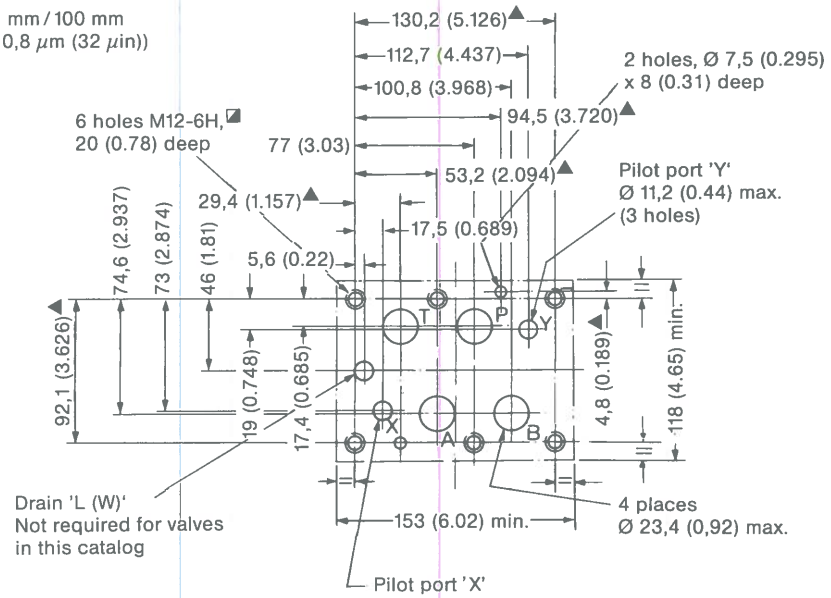
For proportional valves: KFDG5V-8 and KHDG5V-8

## 1. Mounting surface dimensions in mm (inches)

Tolerance ± 0,2 (0.008) except where otherwise indicated

▲ Tolerance on bolt and pin locations ± 0,1 (0.004)

When a subplate is not used a machined pad must be provided for mounting.
The pad must be flat within 0,01 mm / 100 mm (0.0004"/4") and smooth within 0,8 μm (32 μin))




◪ 0.500"-13UNC option to meet ANSI/NFPA standards

## 2. Operating data

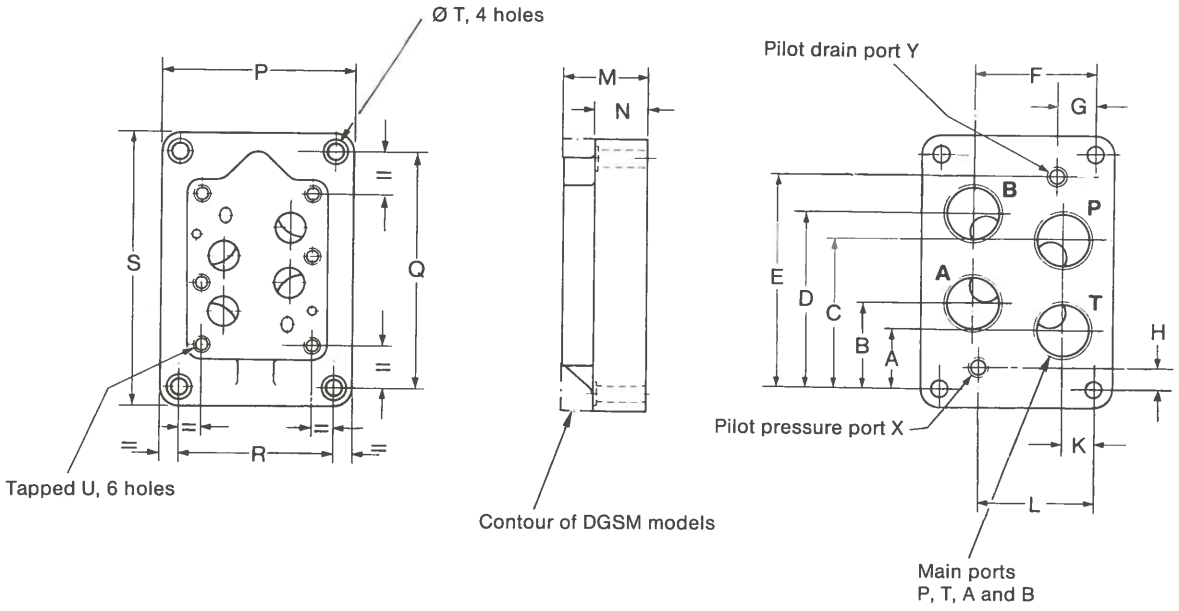
| | |
|---|---|
| Valve mounting surface | ISO 4401-AE-08-4-A |
| Max. pressure | 350 bar (5075 psi)⬓ |
| Subplate dimensions | See next page |
| Subplate<br>DGSM-8<br>EDGVM-8/8X<br>EDGVM-8Y/8Z | <br>5,0 kg (11 lb) approx.<br>5,0 kg (11 lb) approx.<br>13,0 kg (28.6 lb) approx. |
| Bolt kits | See two pages on |

⬓ EDGVM models only. 210 bar (3000 psi) for DGSM models.

## 3. Subplate dimensions in mm (inches)

3rd angle projection

**DGSM-8-10-T** and**
**EDGVM-8(*)-11-R subplates**




| Model | A | B | C | D | E | F | G | H | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DGSM-8-1*-T12 | 54,8 (2.16) | 78,6 (3.09) | 102,4 (4.03) | 126,2 (4.97) | 138 (5.44) | 74,6 (2.94) | 19 (0.75) | 42,9 (1.69) | 17,4 (0.685) | 73 (2.87) | 35 (1.38) |
| DGSM-8-1*-T16 | | | | | | | | | | | |
| EDGVM-8-1*-R | | | | | 160 (6.30) | | | 21,0 (0.83) | | | |
| EDGVM-8X-1*-R | 49,6 (1.95) | 73,4 (2.89) | 107,5 (4.23) | 131,4 (5.17) | | | | | | | |
| EDGVM-8Y-1*-R | 50,5 (1.99) | 74,2 (2.92) | 128,0 (5.04) | 151,8 (5.98) | 185 (7.28) | 103 (4.06) | 33 (1.30) | 17,5 (0.69) | 27,0 (1.06) | 97 (3.82) | 72 (2.84) |
| EDGVM-8Z-1*-R | | | | | | | | | | | |

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| Model | N | P | Q | R | S | Ø T | U | Ports P, A, B & T | Ports X & Y |
|---|---|---|---|---|---|---|---|---|---|
| DGSM-8-1*-T12 | 35 (1.38) | 114 (4.49) | 181 (7.13) | 92,1 (3.63) | 204 (8.03) | 10,3 (0.405) | 0.500"-13 UNC-2B | 1.0625"-12UN x 19,1 (0.75) deep | 0.5625" -18 UNF x 12,7 (0.5) deep |
| DGSM-8-1*-T16 | | | | | | | | 1.3125"-12UN x 19,1 (0.75) deep | |
| EDGVM-8-1*-R | | 119 (4.69) | | | | 10,8 (0.425) | M12 x 25 (1.0) deep | G3/4" x 16 (0.63) deep | G1/4" x 12,2 (0.48) deep |
| EDGVM-8X-1*-R | | | | | | | | G1" x 19 (0.74) deep | |
| EDGVM-8Y-1*-R | 45 (1.77) | 160 (6.30) | 202 (7.95) | 130 (5.12) | 232 (9.13) | 13,5 (0.53) | | G1 1/4" x 21 (0.82) deep | |
| EDGVM-8Z-1*-R | | | | | | | | G1 1/2" x 22 (0.86) deep | |

## 4. Fixing kits

A bolt or stud kit is required to fix a valve stack on a mounting subplate or pad. Bolt/stud lengths vary according to the effective height of the stack.

Selection of fixing kit
1. Total the effective bolt lengths of the stack components (see table 1) to arrive at the effective stack height.
2. Select the related kit from table 2.

**Table 1. Effective bolt lengths of modules and directional valves**

| Model | Length mm (inches) |
|---|---|
| K*DG5V-8 proportional valve | 59 (2.32) |
| DGMA-8 shuttle adaptor<br>KDGMH-8 hydrostat module | 180 (7.09) |

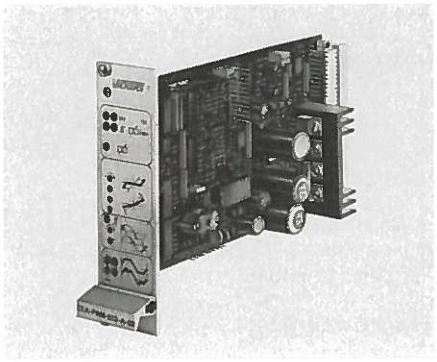
**Table 2. Effective stack height and bolt kits**

| Stack height mm (inches) | Bolt kit (ISO 898 Grade 12.9) Metric 6 x M12▲ | Length mm (inches) | UNC 6 x 0.500"-13UNC▲ | Length mm (inches) |
|---|---|---|---|---|
| 59 (2.32) | BKDG-H8-M | 75 (2.97) | BKDGH06-618 | 76,2 (3.0) |
| 239 (9.41) | BKDG-H8-976129 | 255 (10.04) | BK590723 | 254 (10.0) |

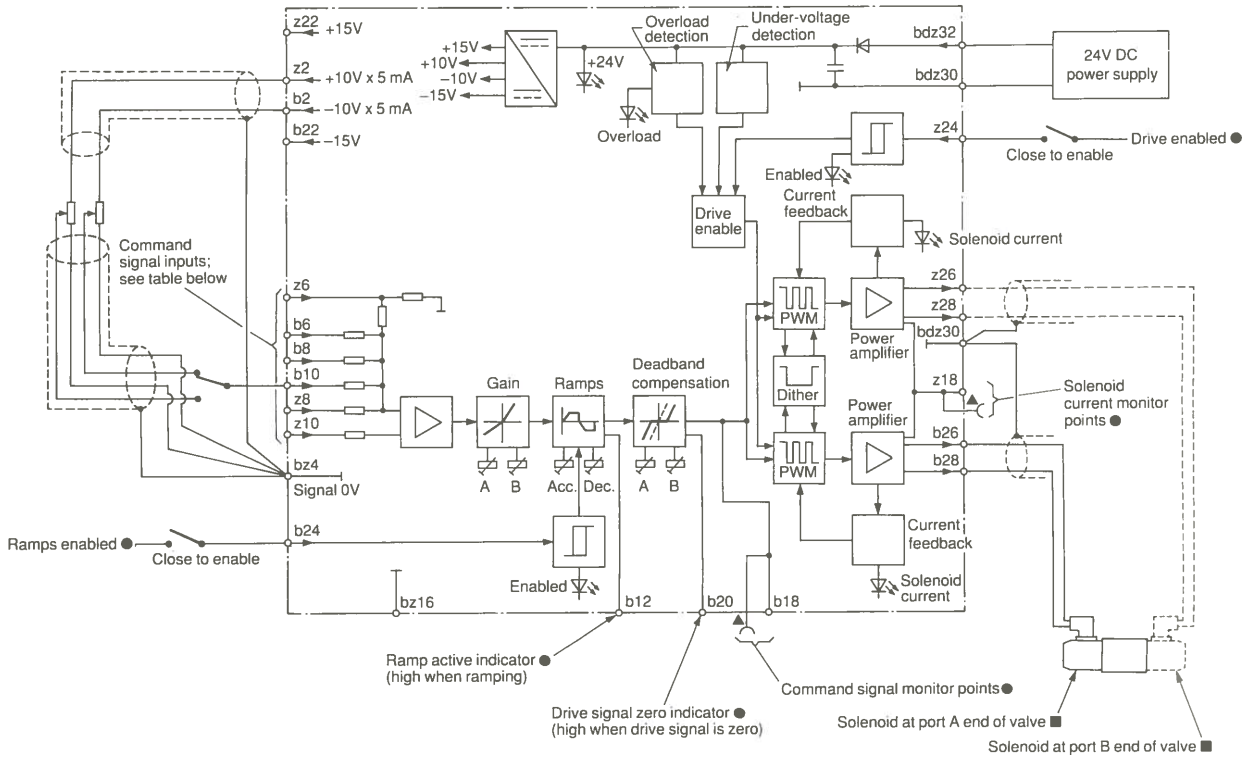
▲ Torque (lubricated) to 103 - 127 Nm (76 - 93 lbf ft)

# Power amplifiers

EEA-PAM-523-A-30 series for K*G4V-3----H7, 20 series valves
EEA-PAM-525-A-30 series for K*G4V-5----H*, 30 series valves



## 1. Circuit and connections




▲ On front panel
● See under this heading in "Operating data", on next two pages
■ One of these relationships may not apply when two single-solenoid valves are connected

### Command signals and outputs

| Command signal Type | Input pins Ref. | Signal polarity | Secondary pins ref. | Valve flow | |
|---|---|---|---|---|---|
| Non-inverting voltages | b6/8/10 or z8 | + | bz4 | P-B | ■ |
| | | − | | P-A | |
| Non-inverting current | z6 | + | | P-B | ■ |
| | | − | | P-A | |
| Inverting voltage | z10 | − | Link *one* of b6/8/10 or z8 to bz4 | P-B | ■ |
| | | + | | P-A | |
| Differential voltage | | − | *One* of b6/8/10 or z8 | P-B | ■ |
| | | + | | P-A | |
| | *One* of b6/8/10 or z8 | + | z10 | P-B | ■ |
| | | − | | P-A | |

SUNNY ENTERPRISES (PVT)
4/7 Panorama Centre
Plot No. 2 Raja Ghazanfar Ali Khan Road
SADDAR KARACHI

## 2. Operating data

| | |
|---|---|
| Power requirements | 24V DC nominal x 40W<br>Maximum voltage range:<br>20-40V (including ripple)<br>Maximum ripple: ±10% pk -to-pk.<br>Amplifier shuts down below<br>18V DC.<br>Reverse-polarity protected. |
| Output voltages, for control:<br>At pins z22 and b22<br><br>At pins z2 and b2 | <br>±15V x 50 mA.<br>Ripple <50 mV pk.-to-pk.<br>±10V(±1%) x 5 mA.<br>Ripple <20 mV pk.-to-pk.<br>Temperature drift <1 mV/°C<br>(<0,5 mV/°F) thru' 0-60°C<br>(32-140°F) range<br>All outputs short-circuit protected |
| Command signal inputs:<br>Direct-voltage pins<br>Inverting-voltage pin<br>Current pin<br>Voltage range<br>Input impedance(voltage)<br>Current range<br>Input impedance (current) | <br>b8,b6,z8,b10<br>z10<br>z6<br>±10V<br>47 kΩ<br>±20 mA<br>100Ω |
| Power drive, two-channel pulse-width-modulated (PWM):<br>Maximum solenoid current | <br>1,6A. Short-circuit protected. |
| Dither | Factory set |
| Deadband compensation, separate controls for both directions from spool-centered position:<br>Factory-setting<br><br>Adjustment per direction | <br><br>10% of max. stroke, from centered position<br>0 to 50% of max. stroke, from centered position |
| Gain, separate controls for both directions from spool-centered position:<br>Factory-setting<br><br>Adjustment per direction | <br><br>Max. spool stroke at 10V command signal from centered position<br>2,5 to 10% of max. spool stroke per 1V from centered position |
| Ramp time adjustment, linear:<br>Factory-setting<br>Independent adjustments for acceleration and deceleration | <br>Minimum (50 ms approx.)<br><br>50 ms to 5s, under pre-set deadband compensation and gain conditions |
| Overload detection, factory-set | Automatic reset when fault removed |
| Drive enabled (power available to solenoid) | Apply >9,8V to <40V at z24 (22 kΩ) |
| Drive disabled (no power to solenoid) | Apply open circuit or up to 4,5V at z24 |
| Ramps enabled (valve switching rate limited by ramp potentiometers) | Apply >9,8V to <40V to b24 (47 kΩ) |
| Ramps disabled (fastest valve switching; ramp circuit bypassed) | Apply open circuit or up to 4,5V to b24 |

*Continued on next page*

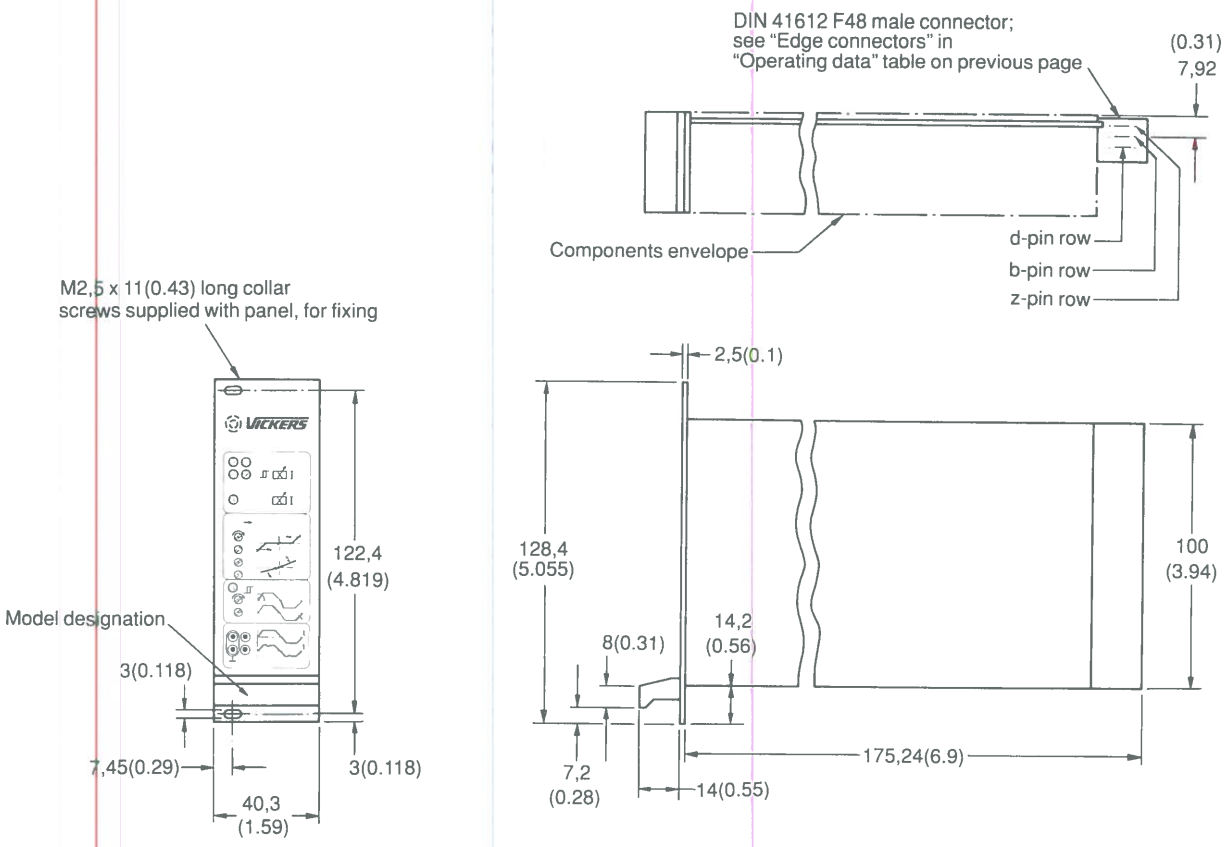
| | |
|---|---|
| Command signal monitor points, front panel and b18<br><br>Output impedance | ±10V full scale. Command signal conditioned by deadband compensation, gain and ramp functions<br>10 kΩ. Short-circuit protected |
| Solenoid current monitor points, front panel and z18<br>Output impedance | 1V/A solenoid current<br>10 kΩ. Short-circuit protected |
| Ramp active indicator, b12:<br>Drive ramping up<br>Drive ramping down<br>Drive not ramping<br>Output resistance | <br>Output >+10V<br>Output <–10V<br>Output 0±10V<br>10 kΩ |
| Drive signal zero indicator, b20:<br>Drive signal at null (within deadband limits)<br><br>Drive active<br>Output resistance | <br>Output = Supply –1,5V;<br>I = 50 mA max.<br>Output = 0±2V<br>50Ω |
| Ambient temperature range | 0 to 60°C (32 to 140°F) |
| Edge connectors | DIN 41612 F48 male type on the board.<br>Mating connector can be F32 or F48 female type |
| Coding pin hole location:<br>EEA-PAM-523-A<br>EEA-PAM-525-A | <br>Between b and d1<br>Between b and d5 |
| Installation dimensions and panel display | See next page |
| Mass | 0,33 kg (0.73 lb) |
| Installation and commissioning (start-up) | See "Contents" pages |
| Supporting products:<br>Power unit options<br>Electronic accessories<br>Portable test equipment | See "Contents" pages |

SUNNY ENTERPRISES (PVT)
411 Panorama Centre
Bldg. No. 2 Raja Ghazanfar Ali Kh
SADDAR KARACHI

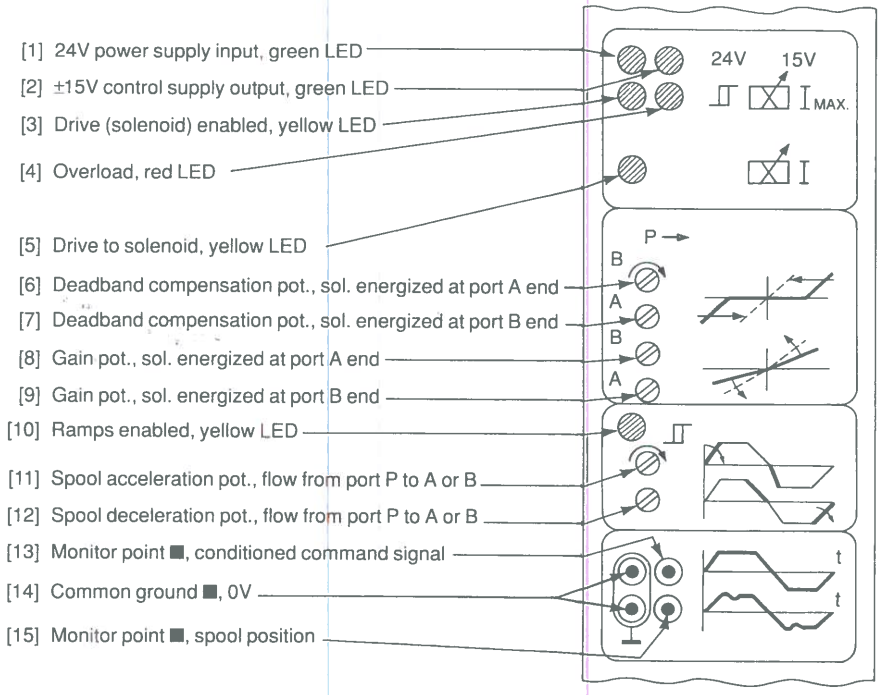
## 3. Installation dimensions, in mm (inches)

3rd angle projection

**Plug-in unit of 3U height, to IEC 297**



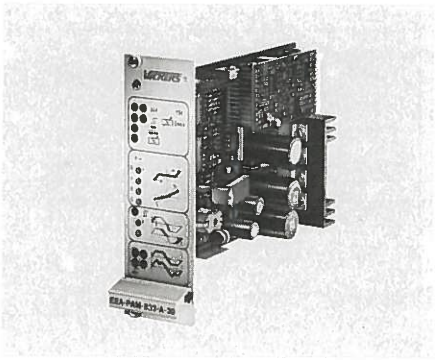

**Panel display, full size**


[1] 24V power supply input, green LED
[2] ±15V control supply output, green LED
[3] Drive (solenoid) enabled, yellow LED
[4] Overload, red LED
[5] Drive to solenoid, yellow LED
[6] Deadband compensation pot., sol. energized at port A end
[7] Deadband compensation pot., sol. energized at port B end
[8] Gain pot., sol. energized at port A end
[9] Gain pot., sol. energized at port B end
[10] Ramps enabled, yellow LED
[11] Spool acceleration pot., flow from port P to A or B
[12] Spool deceleration pot., flow from port P to A or B
[13] Monitor point ■, conditioned command signal
[14] Common ground ■, 0V
[15] Monitor point ■, spool position
24V
15V
I MAX.
P
B
A
B
A
t
t

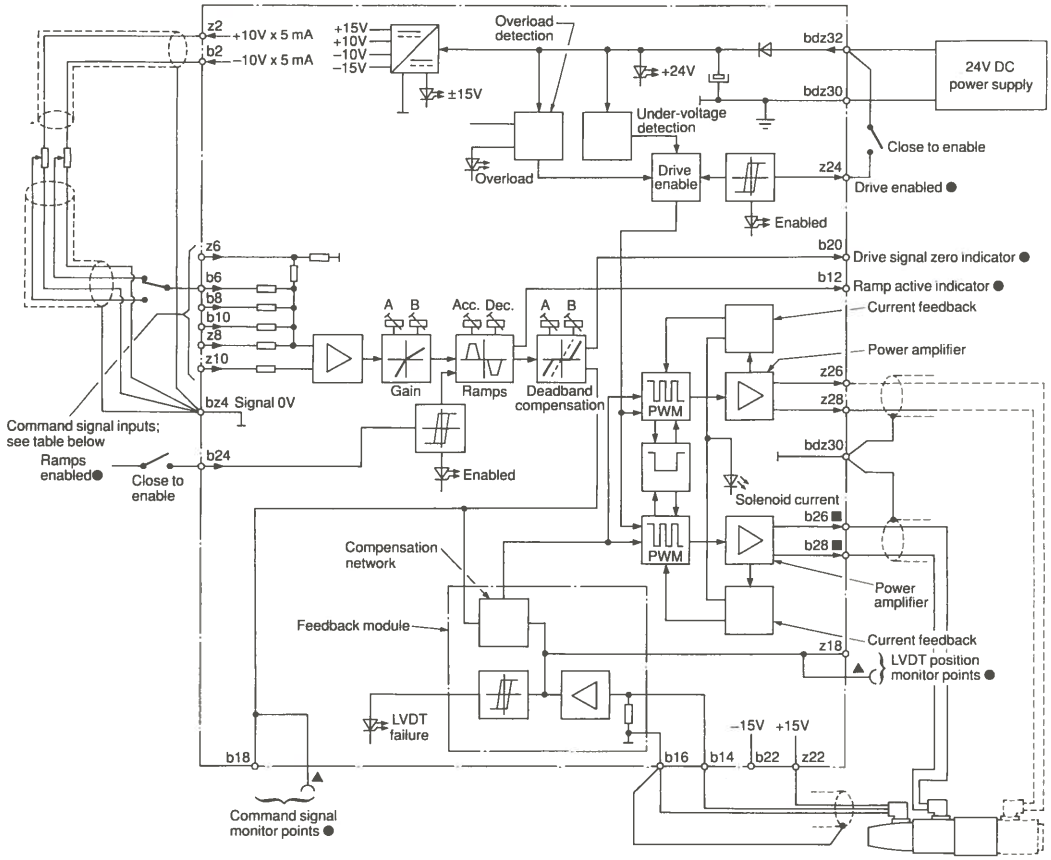
■ Ø2(0.0787 dia.) sockets

# Power amplifiers

EEA-PAM-533-A-30 series for KF*G4V-3, 20 series valves
EEA-PAM-535-A-30 series for KF*G4V-5, 30 series valves



## 1. Circuit and connections




▲ On front panel
● See under this heading in "Operating data" table, on next two pages
■ To solenoid adjacent to LVDT

### Command signals and outputs

| Command signal Type | Input pins Ref. | Signal polarity | Secondary pins ref. | Valve flow |
|---|---|---|---|---|
| Non-inverting voltages | b6/8/10 or z8 | + | bz4 | P-B |
| | | − | | P-A |
| Non-inverting current | z6 | + | | P-B |
| | | − | | P-A |
| Inverting voltage | z10 | − | Link *one* of b6/8/10 or z8 to bz4 | P-B |
| | | + | | P-A |
| Differential voltage | | − | *One* of b6/8/10 or z8 | P-B |
| | | + | | P-A |
| | *One* of b6/8/10 or z8 | + | z10 | P-B |
| | | − | | P-A |

SUNNY ENTERPRISES (PVT)
411 Panorama Centre
Bldg. No. 2 Raja Ghazanfar Ali Kh
SADDAR KARACHI

### LVDT connections

| LVDT plug pin | Amplifier pin |
|---|---|
| 1 | b14 |
| 2 | z22 |
| 3 | b16 |
| 4 | – |

## 2. Operating data

| | |
|---|---|
| Power requirements | 24V DC nominal x 40W<br>Maximum voltage range:<br>20-40V (including ripple)<br>Maximum ripple: ±10% pk.-to-pk.<br>Amplifier shuts down below 18V DC<br>Reverse-polarity protected. |
| Output voltages, for control:<br>At pins z22 and b22<br><br>At pins z2 and b2 | <br>±15V x 50 mA.<br>Ripple <50 mV pk.-to-pk.<br>±10V (±1%) x 5 mA.<br>Ripple <20 mV pk.-to-pk.<br>Temperature drift <1 mV/°C<br>(<0,5 mV/°F) thru' 0-60°C<br>(32-140°F) range<br>All outputs short-circuit protected |
| Command signal inputs:<br>Direct-voltage pins<br>Inverting-voltage pin<br>Current pin<br>Voltage range<br>Input impedance (voltage)<br>Current range<br>Input impedance (current) | <br>b8, b6, z8, b10<br>z10<br>z6<br>±10V<br>47 kΩ<br>±20 mA<br>100Ω |
| Power drive, two channel pulse-width-modulated (PWM):<br>Max. solenoid current | <br>2,7A. Short-circuit protected |
| Deadband compensation, separate controls for both directions from spool-centered position:<br>Factory-setting<br><br>Adjustment per direction | <br>10% of max. stroke, from centered position<br>0 to 50% of max. stroke, from centered position |
| Gain, separate controls for both directions from spool-centered position:<br>Factory-setting<br><br>Adjustment per direction | <br>Max. spool stroke at 10V command signal from centered position<br>2,5 to 10% of max. spool stroke per 1V from centered position |
| Ramp time adjustment, linear:<br>Factory-setting<br>Independent adjustments for acceleration and deceleration | <br>Minimum (50 ms approx.)<br><br>50 ms to 5 s, under pre-set deadband compensation and gain conditions |
| Feedback from LVDT to b14 | 4 to 20 mA (100Ω) |
| Overload detection, factory-set | Automatic reset when fault removed |
| Drive enabled (power available to solenoid) | Apply >9,8V to <40V at z24 (22 kΩ) |
| Drive disabled (no power to solenoid) | Apply open circuit or up to 4,5V at z24 |
| Ramps enabled (valve switching rate limited by ramp potentiometers) | Apply >9,8V to <40V to b24 (47 kΩ) |
| Ramps disabled (fastest valve switching; ramp circuit bypassed) | Apply open circuit or up to 4,5V to b24 |
| Command signal monitor points, front panel and b18<br><br>Output impedance | ±10V full scale. Command signal conditioned by deadband compensation, gain and ramp functions<br>10 kΩ. Short-circuit protected |

*Continued on next page*

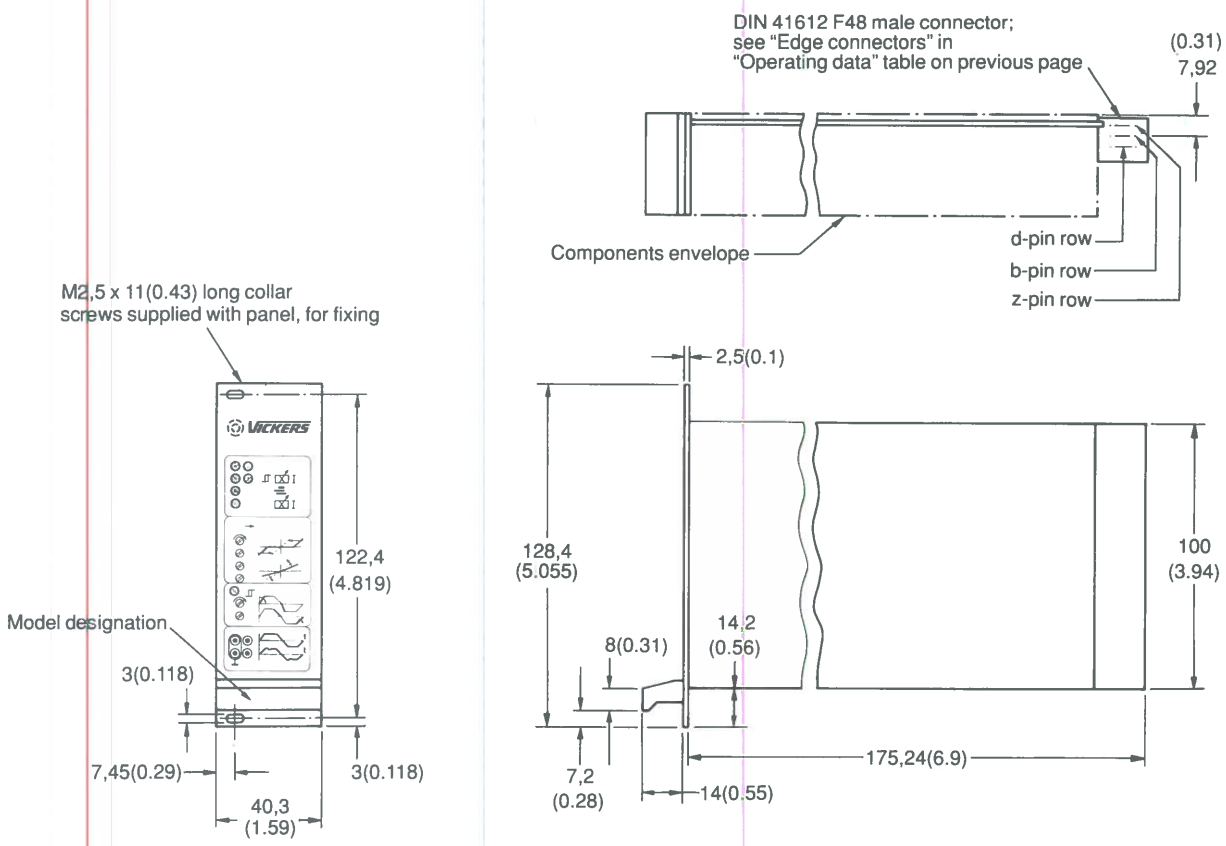
| | |
|---|---|
| LVDT (spool) position monitor points,<br>front panel and z18<br>Output impedance | <br>±10V at full stroke<br>10 kΩ. Short-circuit protected |
| Ramp active indicator, b12:<br>Drive ramping up<br>Drive ramping down<br>Drive not ramping<br>Output resistance | <br>Output >10V<br>Output <–10V<br>Output 0 ±10V<br>10 kΩ |
| Drive signal zero indicator, b20:<br>Drive signal at null (within deadband limits)<br><br>Drive active<br>Output resistance | <br>Output = Supply –1,5V;<br>I = 50 mA max.<br>Output = 0 ±2V<br>50Ω |
| Ambient temperature range | 0 to 60°C (32 to 140°F) |
| Edge connectors | DIN 41612 F48 male type on the board<br>Mating connector can be F32 or F48 female type |
| Coding pin hole location:<br>EEA-PAM-533-A<br>EEA-PAM-535-A | <br>Between b and d7<br>Between b and d13 |
| Installation dimensions and panel display | See next page |
| Mass | 0,33 kg (0.73 lb) |
| Installation and commissioning (start-up) | See "Contents" pages |
| Supporting products:<br>Power unit options<br>Electronic accessories<br>Portable test equipment | See "Contents" pages |

SONNY ENTERPRISES (PAK)
411 Panorama Centre
Plot No. 2 Raja Ghazanfar Ali Khan Road
KARACHI

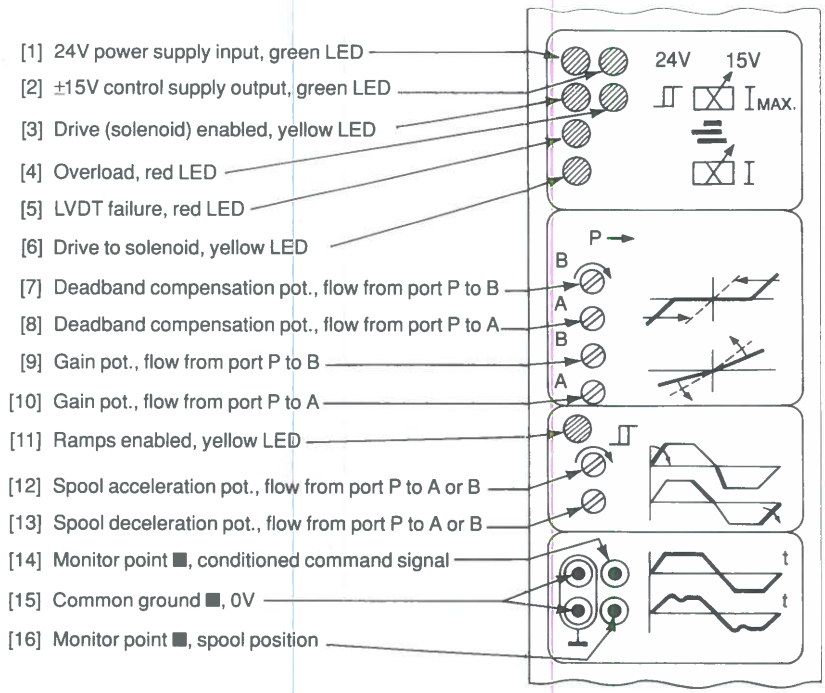
## 3. Installation dimensions, in mm (inches)

3rd angle projection

**Plug-in unit of 3U height, to IEC 297**



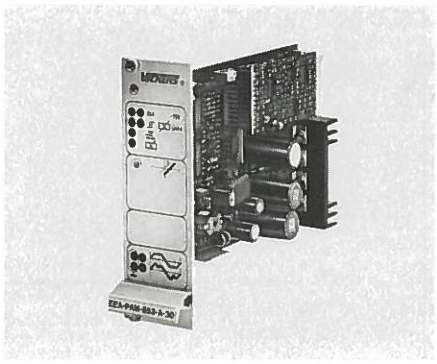

**Panel display, full size**


[1] 24V power supply input, green LED
[2] ±15V control supply output, green LED
[3] Drive (solenoid) enabled, yellow LED
[4] Overload, red LED
[5] LVDT failure, red LED
[6] Drive to solenoid, yellow LED
[7] Deadband compensation pot., flow from port P to B
[8] Deadband compensation pot., flow from port P to A
[9] Gain pot., flow from port P to B
[10] Gain pot., flow from port P to A
[11] Ramps enabled, yellow LED
[12] Spool acceleration pot., flow from port P to A or B
[13] Spool deceleration pot., flow from port P to A or B
[14] Monitor point ■, conditioned command signal
[15] Common ground ■, 0V
[16] Monitor point ■, spool position
24V
15V
I MAX.
I
P
B
A
B
A
t
t

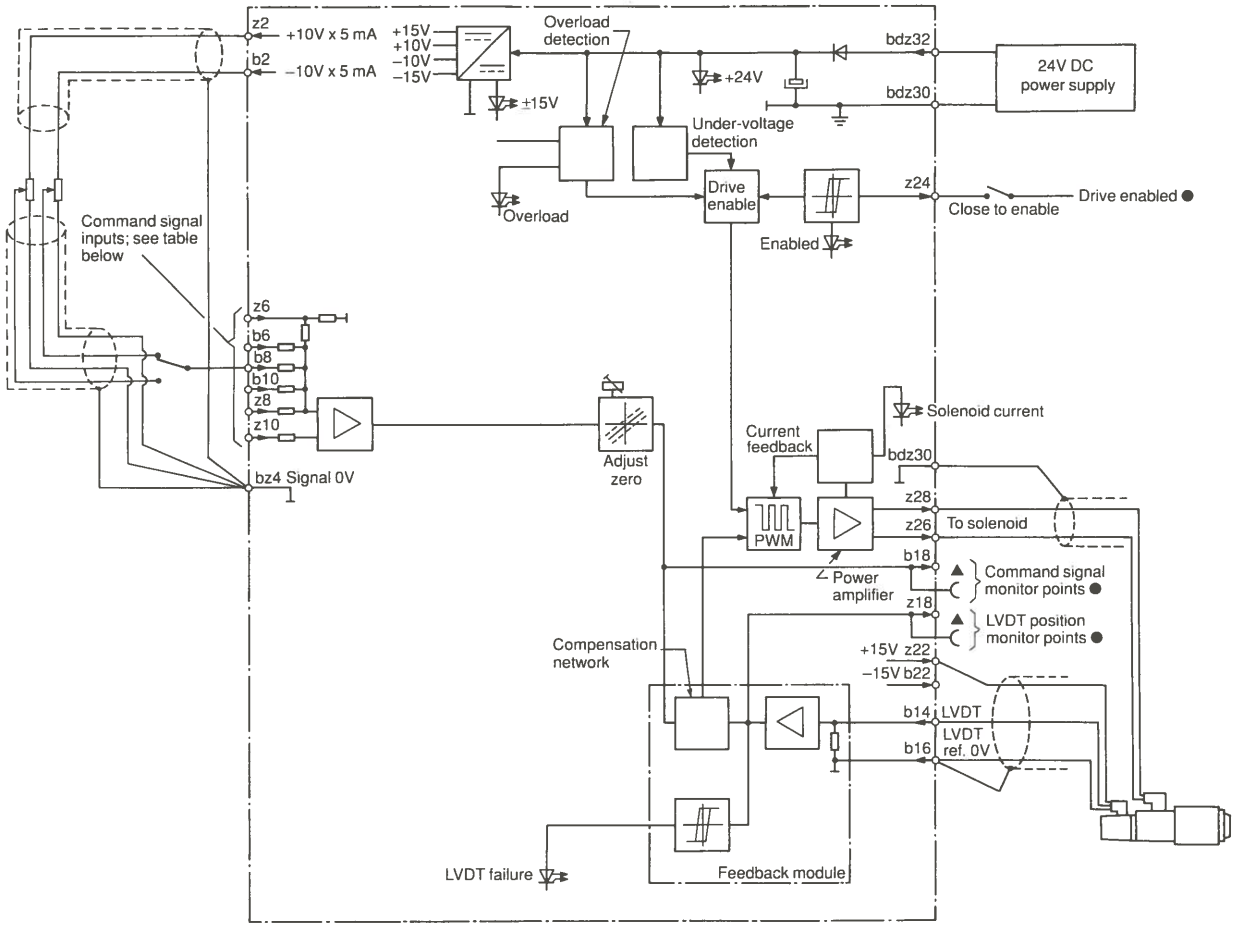
■ Ø2(0.0787 dia.) sockets

# Power amplifier

EEA-PAM-553-A-30 series
for KSDG4V-3, 10 series valves



## 1. Circuit and connections




### Command signals and outputs

| Command signal Type | Input pins Ref. | Signal polarity | Secondary pins ref. | Valve flow |
|---|---|---|---|---|
| Non-inverting voltages | b6/8/10 or z8 | + | bz4 | P-B |
| | | − | | P-A |
| Non-inverting current | z6 | + | | P-B |
| | | − | | P-A |
| Inverting voltage | z10 | − | Link *one* of b6/8/10 or z8 to bz4 | P-B |
| | | + | | P-A |
| Differential voltage | | − | *One* of b6/8/10 or z8 | P-B |
| | | + | | P-A |
| | *One* of b6/8/10 or z8 | + | z10 | P-B |
| | | − | | P-A |

▲ On front panel
● See under this heading in "Operating data" table, on next two pages

### LVDT connections

| LVDT plug pin | Amplifier pin |
|---|---|
| 1 | b14 |
| 2 | z22 |
| 3 | b16 |
| 4 | – |

## 2. Operating data

| | |
|---|---|
| Power requirements | 24V DC nominal x 40W<br>Maximum voltage range:<br>20-40V (including ripple).<br>Maximum ripple: ±10% pk.-to-pk.<br>Amplifier shuts down below<br>18V DC.<br>Reverse-polarity protected.<br>See "Warning" note at bottom of next page. |
| Output voltages, for control:<br>At pins z22 and b22<br><br>At pins z2 and b2 | <br>±15V x 50 mA.<br>Ripple <50 mV pk.-to-pk.<br>±10V(±1%) x 5 mA.<br>Ripple <20 mV pk.-to-pk.<br>Temperature drift <1 mV/°C<br>(<0,5 mV/°F) thru' 0-60°C<br>(32-140°F) range.<br>All outputs short-circuit protected |
| Command signal inputs:<br>Direct-voltage pins<br>Inverting-voltage pin<br>Current pin<br>Voltage range<br>Input impedance(voltage)<br>Current range<br>Input impedance (current) | <br>b8,b6,z8,b10<br>z10<br>z6<br>±10V<br>47 kΩ<br>±20 mA<br>100Ω |
| Power drive, single channel pulse-width-modulated (PWM):<br>Standing solenoid current at zero command signal<br>Working range | <br><br>1,7A.<br>0 to 3,2A. Short-circuit protected<br>Note: A positive signal to a non-inverting signal pin reduces solenoid current |
| Adjust valve zero | Multi-turn potentiometer<br>±25% of full range |
| Feedback from LVDT to b14 | 4 to 20 mA (100Ω) |
| Overload detection, factory set | Automatic reset when fault removed |
| Drive enabled (power available to solenoid) | Apply >9,8V to <40V at z24<br>(22 kΩ) |
| Drive disabled (no power to solenoid) | Apply open circuit or up to 4,5V at z24 |
| Command signal monitor points, front panel and b18<br><br>Output impedance | ±10V full scale. Command signal conditioned by deadband compensation, gain and ramp functions<br>10 kΩ. Short-circuit protected |
| LVDT (spool) position monitor points, front panel and z18<br>Ouput impedance | ±10V at full stroke<br>10 kΩ. Short-circuit protected |
| Drive signal zero indicator, b20:<br>Drive signal at null (within deadband limits)<br><br>Drive active<br>Output resistance | <br>Output = Supply –1,5V;<br>I = 50 mA max.<br>Output = 0±2V<br>50Ω |

*Continued on next page*

| | |
|---|---|
| Ambient temperature range | 0 to 60°C (32 to 140°F) |
| Edge connectors | DIN 41612 F48 male type on the board.<br>Mating connector can be F32 or F48 female type |
| Coding pin hole location | Between b and d15 |
| Installation dimensions and panel display | See next page |
| Mass | 0,33 kg (0.73 lb) |
| Installation and commissioning (start-up) | See "Contents" pages |
| Supporting products:<br>Power unit options<br>Electronic accessories<br>Portable test equipment | See "Contents" pages |

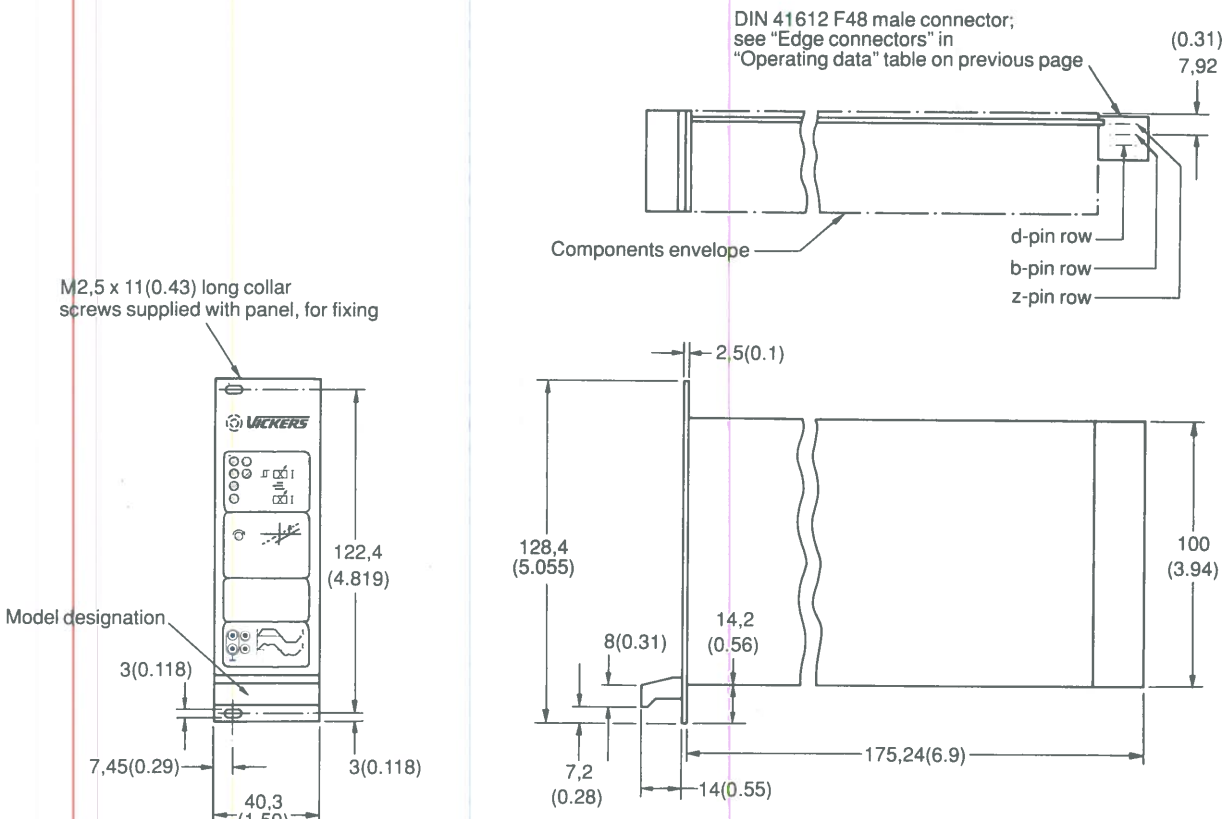
**Warning**
To avoid possible uncontrolled movement of actuators on start-up, the power supply to the amplifier must be up to its rated voltage at least 0,5 seconds before pressure is applied to the valve.

SUNNY ENTERPRISES (PVT)
411 Panorama Centre
Bldg No 2 Raja Ghazanfar Ali Khan Road
SADDAR KARACHI

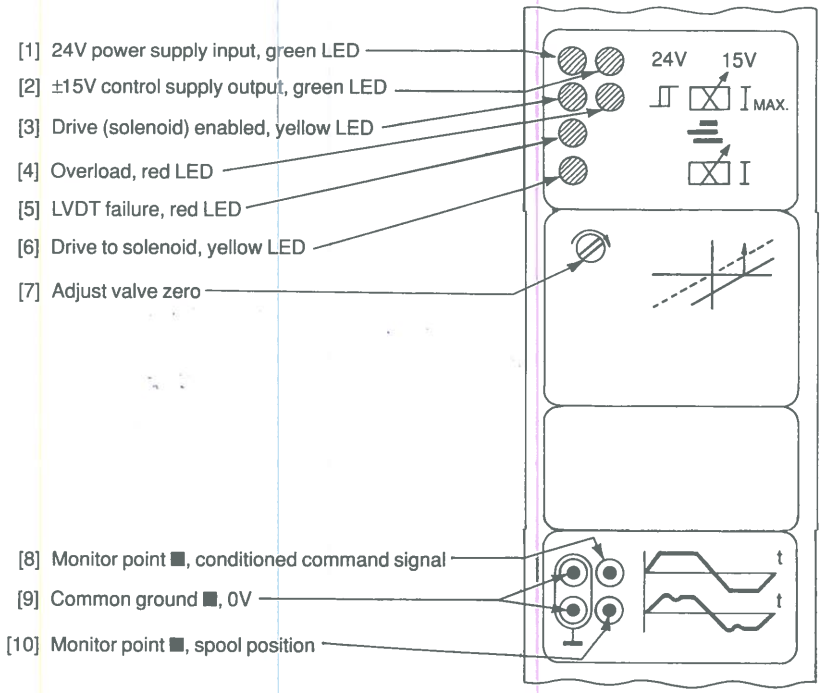
## 3. Installation dimensions in mm (inches)

3rd angle projection

**Plug-in unit of 3U height, to IEC 297**



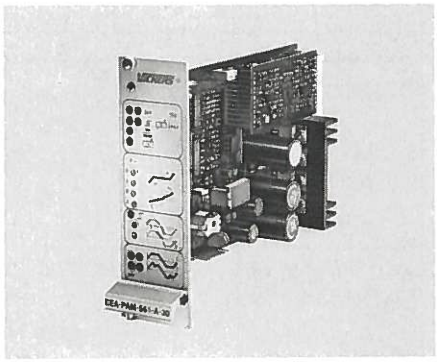

**Panel display, full size**


[1] 24V power supply input, green LED
[2] ±15V control supply output, green LED
[3] Drive (solenoid) enabled, yellow LED
[4] Overload, red LED
[5] LVDT failure, red LED
[6] Drive to solenoid, yellow LED
[7] Adjust valve zero
24V
15V
I MAX.
I
[8] Monitor point ■, conditioned command signal
[9] Common ground ■, 0V
[10] Monitor point ■, spool position
t
t

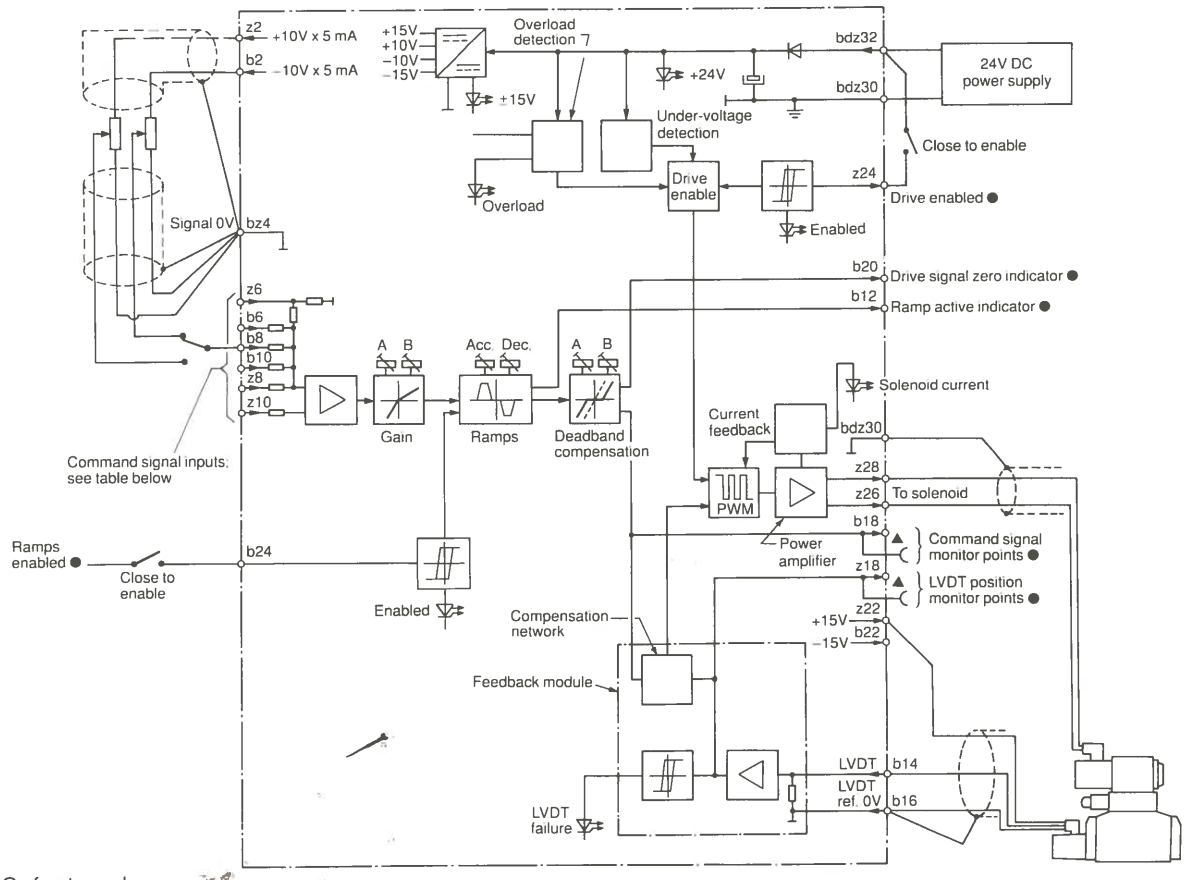
■ Ø2(0.0787 dia.) sockets

# Power amplifier

EEA-PAM-561-A-30 series
for KFDG5V-5, 30 series valves and
KFDG5V-7, 10 series valves
EEA-PAM-568-A-30 series
for KFDG5V-8, 10 series valves



## 1. Circuit and connections




▲ On front panel
● See under this heading in "Operating data" table, on next two pages

SONNY ENTERPRISES (PVT)
411 Panorama Centre
Bldg. No. 2 Raja Ghazanfar Ali Kh. Road
SADDAR KARACHI

### Command signals and outputs

| Command signal Type | Input pins Ref. | Signal polarity | Secondary pins ref. | Valve flow |
|---|---|---|---|---|
| Non-inverting voltages | b6/8/10 or z8 | + | bz4 | P-B |
| | | − | | P-A |
| Non-inverting current | z6 | + | | P-B |
| | | − | | P-A |
| Inverting voltage | z10 | − | Link *one* of b6/8/10 or z8 to bz4 | P-B |
| | | + | | P-A |
| Differential voltage | | − | *One* of b6/8/10 or z8 | P-B |
| | | + | | P-A |
| | *One* of b6/8/10 or z8 | + | z10 | P-B |
| | | − | | P-A |

### LVDT connections

| LVDT plug pin | Amplifier pin |
|---|---|
| 1 | b14 |
| 2 | z22 |
| 3 | b16 |
| 4 | – |

## 2. Operating data

| | |
|---|---|
| Power requirements | 24V DC nominal x 40W<br>Maximum voltage range:<br>20-40V (including ripple).<br>Maximum ripple: ±10% pk.-to-pk.<br>Amplifier shuts down below 18V DC.<br>Reverse-polarity protected.<br>See "Warning" note at bottom of next page |
| Output voltages, for control:<br>At pins z22 and b22<br><br>At pins z2 and b2 | <br>±15V x 50 mA.<br>Ripple <50 mV pk.-to-pk.<br>±10V (±1%) x 5 mA.<br>Ripple <20 mV pk.-to-pk.<br>Temperature drift <1 mV/°C (<0,5 mV°F) thru' 0-60°C (32-140°F) range.<br>All outputs short-circuit protected |
| Command signal inputs:<br>Direct-voltage pins<br>Inverting-voltage pin<br>Current pin<br>Voltage range<br>Input impedance (voltage)<br>Current range<br>Input impedance (current) | <br>b8, b6, z8, b10<br>z10<br>z6<br>±10V<br>47 kΩ<br>±20 mA<br>100Ω |
| Power drive, single channel pulse-width-modulated (PWM):<br>Standing solenoid current at zero command signal<br>Working range | <br><br>1,4A<br>1,0 to 1,8A. Short-circuit protected<br>Note: A positive signal to a non-inverting signal pin reduces solenoid current |
| Dither | Factory set |
| Deadband compensation, separate controls for both directions from spool-centered position:<br>Factory-setting<br><br>Adjustment per direction | <br><br>10% of max. stroke, from centered position<br>0 to 50% of max. stroke, from centered position |
| Gain, separate controls for both directions from spool-centered position:<br>Factory-setting<br><br>Adjustment per direction | <br><br>Max. spool stroke at 10V command signal from centered position<br>2,5 to 10% of max. spool stroke per 1V from centered position |
| Ramp time adjustment, linear:<br>Factory-setting<br>Independent adjustments for acceleration and deceleration | <br>Minimum (50 ms approx.)<br><br>50 ms to 5 s, under pre-set deadband compensation and gain conditions |
| Feedback from LVDT to b14 | 4 to 20 mA (100Ω) |
| Overload detection, factory-set | Automatic reset when fault removed |
| Drive enabled (power available to solenoid) | Apply >9,8V to <40V at z24 (22 kΩ) |
| Drive disabled (no power to solenoid) | Apply open circuit or up to 4,5V at z24 |

*Continued on next page*

| | |
|---|---|
| Ramps enabled (valve switching rate limited by ramp potentiometers) | Apply >9,8V to <40V to b24 (47 kΩ) |
| Ramps disabled (fastest valve switching; ramp circuit bypassed) | Apply open circuit or up to 4,5V to b24 |
| Command signal monitor points, front panel and b18<br><br>Output impedance | ±10V full scale. Command signal conditioned by deadband compensation, gain and ramp functions<br>10 kΩ. Short-circuit protected |
| LVDT (main spool) position monitor points, front panel and z18<br>Output impedance | ±10V at full stroke<br>10 kΩ. Short-circuit protected |
| Ramp active indicator, b12:<br>Drive ramping up<br>Drive ramping down<br>Drive not ramping<br>Output resistance | <br>Output >10V<br>Output <–10V<br>Output 0 ±10V<br>10 kΩ |
| Drive signal zero indicator, b20:<br>Drive signal at null (within deadband limits)<br><br>Drive active<br>Output resistance | <br><br>Output = Supply –1,5V; I = 50 mA max.<br>Output = 0 ±2V<br>50Ω |
| Ambient temperature range | 0 to 60°C (32 to 140°F) |
| Edge connectors | DIN 41612 F48 male type on the board<br>Mating connector can be F32 or F48 female type |
| Coding pin hole location | Between b and d9 |
| Installation dimensions and panel display | See next page |
| Mass | 0,33 kg (0.73 lb) |
| Installation and commissioning (start-up) | See "Contents" pages |
| Supporting products:<br>Power unit options<br>Electronic accessories<br>Portable test equipment | See "Contents" pages |

**Warning**
To avoid possible uncontrolled movement of actuators on start-up, the power supply to the amplifier must be up to its rated voltage at least 0.5 seconds before pressure is applied to the valve.

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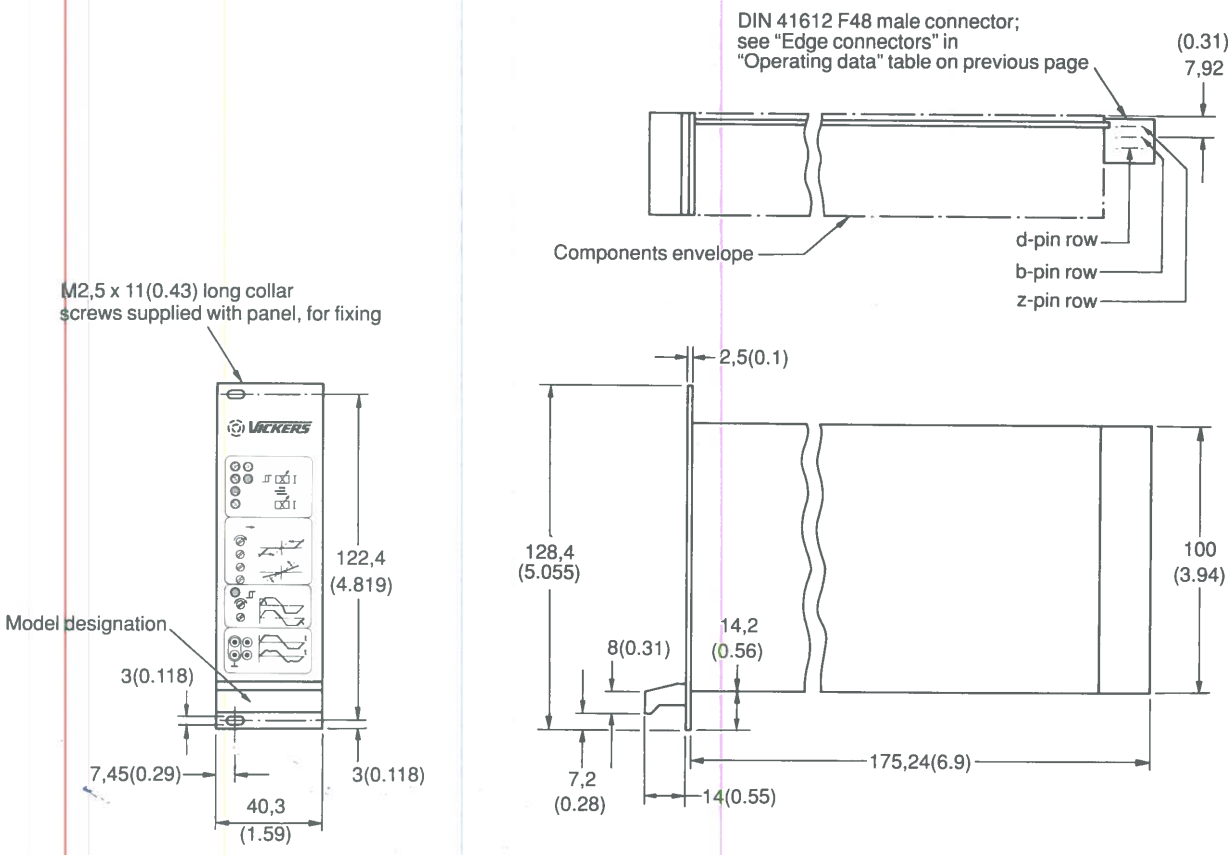
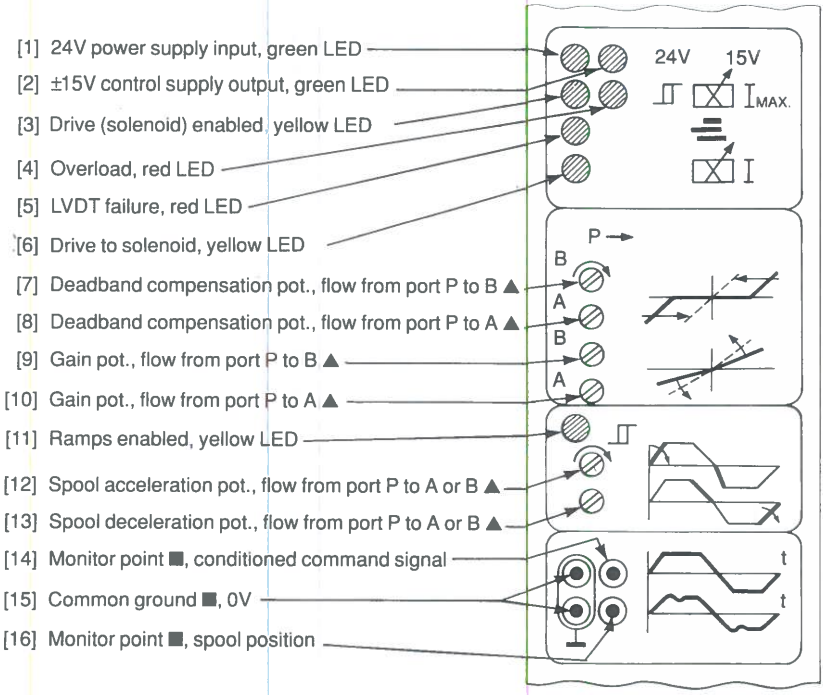
## 3. Installation dimensions, in mm (inches)

**Plug-in unit of 3U height, to IEC 297**

3rd angle projection



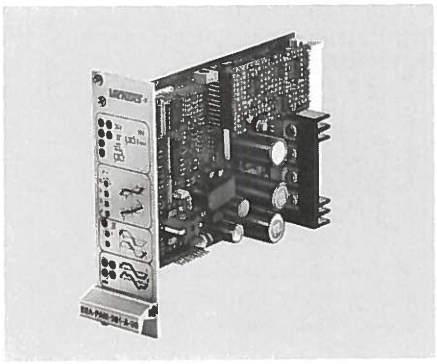

**Panel display, full size**


[1] 24V power supply input, green LED
[2] ±15V control supply output, green LED
[3] Drive (solenoid) enabled, yellow LED
[4] Overload, red LED
[5] LVDT failure, red LED
[6] Drive to solenoid, yellow LED
[7] Deadband compensation pot., flow from port P to B ▲
[8] Deadband compensation pot., flow from port P to A ▲
[9] Gain pot., flow from port P to B ▲
[10] Gain pot., flow from port P to A ▲
[11] Ramps enabled, yellow LED
[12] Spool acceleration pot., flow from port P to A or B ▲
[13] Spool deceleration pot., flow from port P to A or B ▲
[14] Monitor point ■, conditioned command signal
[15] Common ground ■, 0V
[16] Monitor point ■, spool position
24V
15V
IMAX.
P
B
A
B
A
t
t

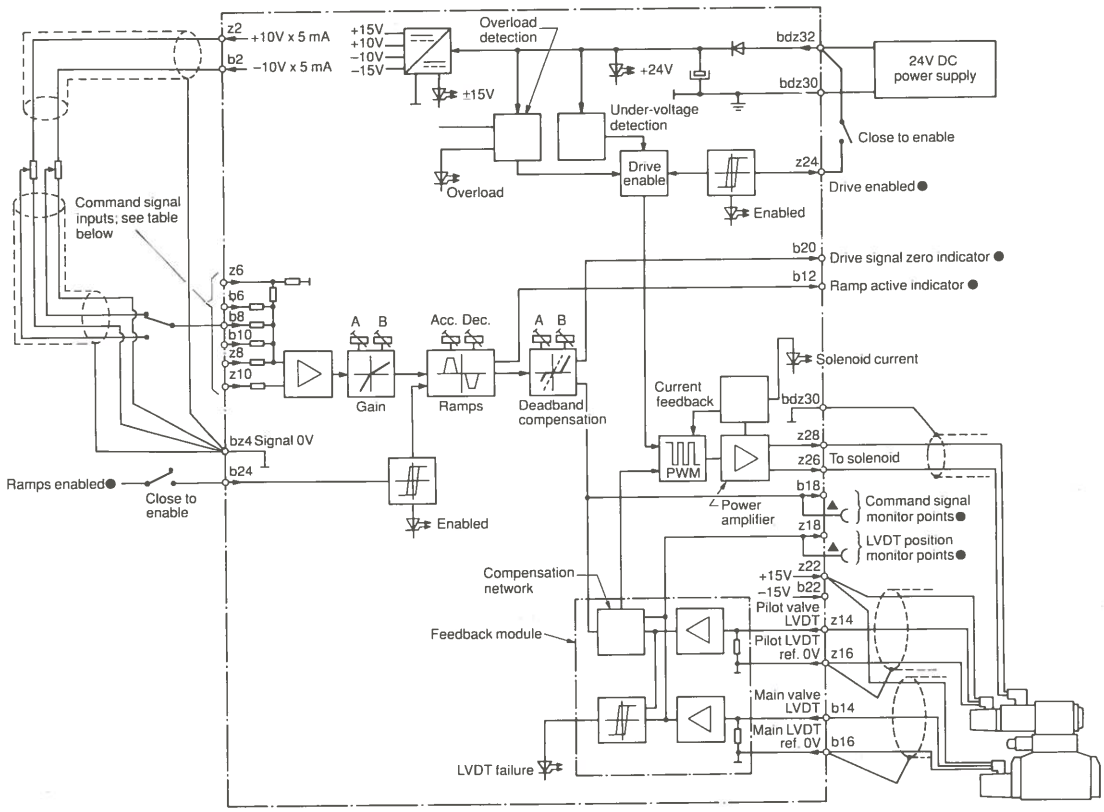
▲ Main-stage spool ■ Ø2(0.0787 dia.) sockets

# Power amplifier

EEA-PAM-581-A-30 series
for KHDG5V-5/7/8, 20 series valves



## 1. Circuit and connections

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▲ On front panel
● See under this heading in "Operating data" table, on next two pages

### Command signals and outputs

| Command signal Type | Input pins Ref. | Signal polarity | Secondary pins ref. | Valve flow |
|---|---|---|---|---|
| Non-inverting voltages | b6/8/10 or z8 | + | bz4 | P-B |
| | | − | | P-A |
| Non-inverting current | z6 | + | | P-B |
| | | − | | P-A |
| Inverting voltage | z10 | − | Link *one* of b6/8/10 or z8 to bz4 | P-B |
| | | + | | P-A |
| Differential voltage | | − | *One* of b6/8/10 or z8 | P-B |
| | | + | | P-A |
| | *One* of b6/8/10 or z8 | + | z10 | P-B |
| | | − | | P-A |

### LVDT connections

| Pilot-stage LVDT plug pin | Amplifier pin |
|---|---|
| 1 | z14 |
| 2 | z22 |
| 3 | z16 |
| 4 | – |

| Main-stage LVDT plug pin | Amplifier pin |
|---|---|
| 1 | b14 |
| 2 | z22 |
| 3 | b16 |
| 4 | – |

## 2. Operating data

| | |
|---|---|
| Power requirements | 24V DC nominal x 40W<br>Maximum voltage range:<br>20-40V (including ripple).<br>Maximum ripple: ±10% pk.-to-pk.<br>Amplifier shuts down below<br>18V DC.<br>Reverse-polarity protected.<br>See "Warning" note at bottom of next page. |
| Output voltages, for control:<br>At pins z22 and b22<br><br>At pins z2 and b2 | <br>±15V x 50 mA.<br>Ripple <50 mV pk.-to-pk.<br>±10V(±1%) x 5 mA.<br>Ripple <20 mV pk.-to-pk.<br>Temperature drift <1 mV/°C<br>(<0,5 mV/°F) thru' 0-60°C<br>(32-140°F) range.<br>All outputs short-circuit protected |
| Command signal inputs:<br>Direct-voltage pins<br>Inverting-voltage pin<br>Current pin<br>Voltage range<br>Input impedance(voltage)<br>Current range<br>Input impedance (current) | <br>b8,b6,z8,b10<br>z10<br>z6<br>±10V<br>47 kΩ<br>±20 mA<br>100Ω |
| Power drive, single channel pulse-width-modulated (PWM):<br>Standing solenoid current at zero command signal<br>Max. current | <br><br>1,7A<br>2,2A. Short-circuit protected.<br>Note: A positive signal to a non-inverting signal pin reduces solenoid current |
| Deadband compensation, separate controls for both directions from spool-centered position:<br>Factory-setting<br><br>Adjustment per direction | <br><br>10% of max. stroke, from centered position<br>0 to 50% of max. stroke, from centered position |
| Gain, separate controls for both directions from spool-centered position:<br>Factory-setting<br><br>Adjustment per direction | <br><br>Max. spool stroke at 10V command signal from centered position<br>2,5 to 10% of max. spool stroke per 1V from centered position |
| Ramp time adjustment, linear:<br>Factory-setting<br>Independent adjustments for acceleration and deceleration | <br>Minimum (50 ms approx.)<br><br>50 ms to 5 s, under pre-set deadband compensation and gain conditions |
| Feedback from:<br>Pilot-stage LVDT to z14<br>Main-stage LVDT to b14 | <br>4 to 20 mA (100Ω)<br>4 to 20 mA (100Ω) |
| Overload detection, factory-set | Automatic reset when fault removed |
| Drive enabled (power available to solenoid) | Apply >9,8V to <40V at z24 (22 kΩ) |

*Continued on next page*

| | |
|---|---|
| Drive disabled (no power to solenoid) | Apply open circuit or up to 4,5V at z24 |
| Ramps enabled (valve switching rate limited by ramp potentiometers) | Apply >9,8V to <40V to b24 (47 kΩ) |
| Ramps disabled (fastest valve switching; ramp circuit bypassed) | Apply open circuit or up to 4,5V to b24 |
| Command signal monitor points, front panel and b18<br><br>Output impedance | ±10V full scale. Command signal conditioned by deadband compensation, gain and ramp functions<br>10 kΩ. Short-circuit protected |
| LVDT (main spool) position monitor points, front panel and z18<br>Output impedance | ±10V at full stroke<br>10 kΩ. Short-circuit protected |
| Ramp active indicator, b12:<br>Drive ramping up<br>Drive ramping down<br>Drive not ramping<br>Output resistance | <br>Output >10V<br>Output <–10V<br>Output 0±10V<br>10 kΩ |
| Drive signal zero indicator, b20:<br>Drive signal at null (within deadband limits)<br><br>Drive active<br>Output resistance | <br><br>Output = Supply –1,5V;<br>I = 50 mA max.<br>Output = 0±2V<br>50Ω |
| Ambient temperature range | 0 to 60°C (32 to 140°F) |
| Edge connectors | DIN 41612 F48 male type on the board.<br>Mating connector can be F32 or F48 female type |
| Coding pin hole location | Between b and d11 |
| Installation dimensions and panel display | See next page |
| Mass | 0,33 kg (0.73 lb) |
| Installation and commissioning (start-up) | See "Contents" pages |
| Supporting products:<br>Power unit options<br>Electronic accessories<br>Portable test equipment | See "Contents" pages |

**Warning**
To avoid possible uncontrolled movement of actuators on start-up, the power supply to the amplifier must be up to its rated voltage at least 0.5 seconds before pressure is applied to the valve.

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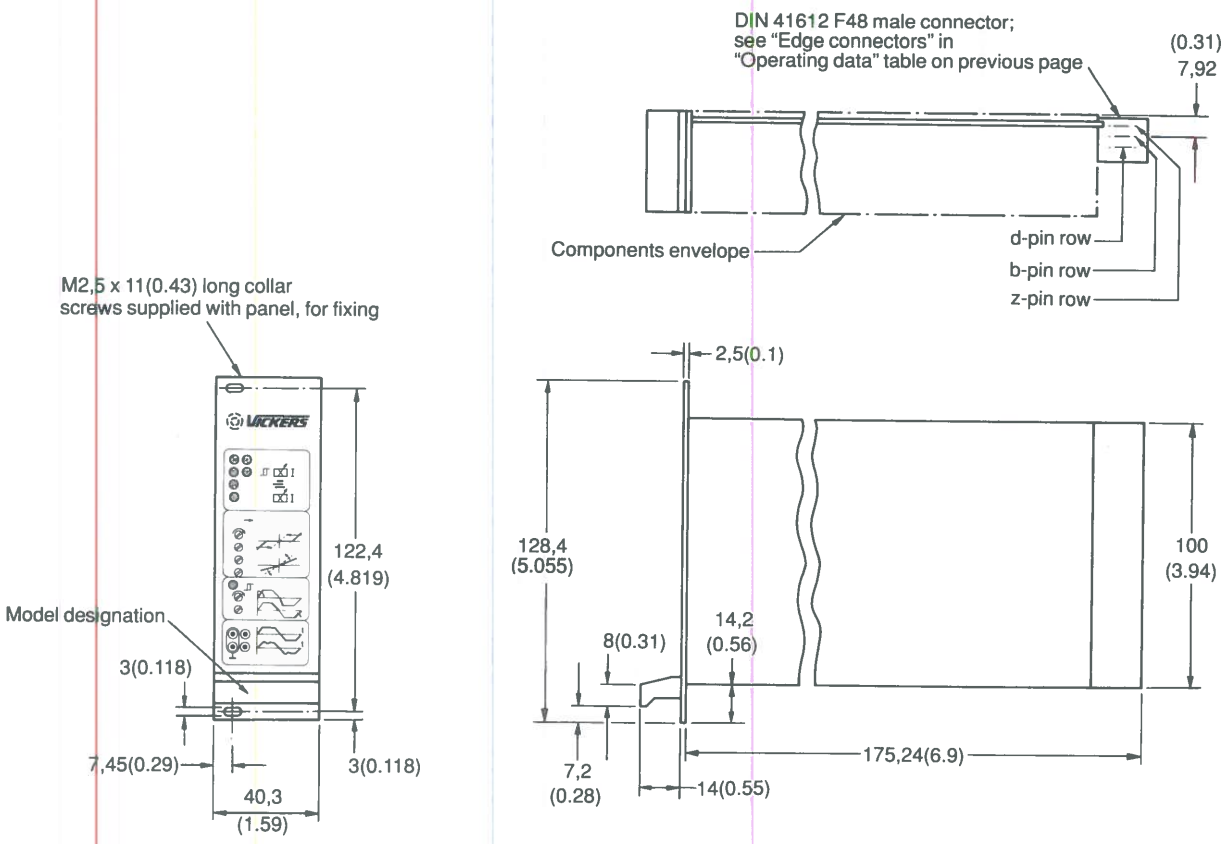
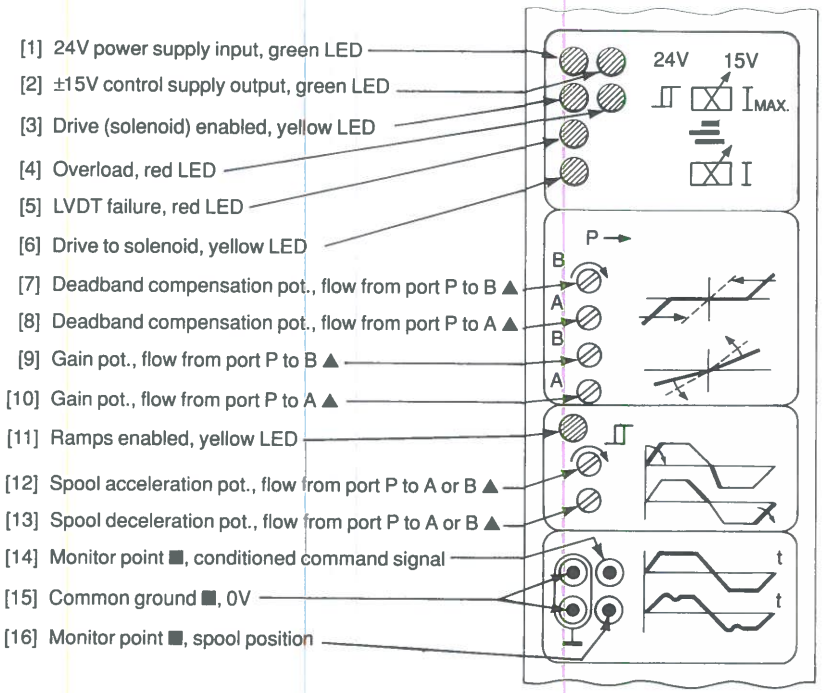
## 3. Installation dimensions, in mm (inches)

**Plug-in unit of 3U height, to IEC 297**

3rd angle projection




**Panel display, full size**


[1] 24V power supply input, green LED
[2] ±15V control supply output, green LED
[3] Drive (solenoid) enabled, yellow LED
[4] Overload, red LED
[5] LVDT failure, red LED
[6] Drive to solenoid, yellow LED
[7] Deadband compensation pot., flow from port P to B ▲
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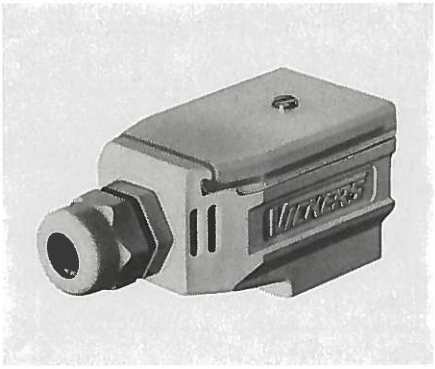
[9] Gain pot., flow from port P to B ▲
[10] Gain pot., flow from port P to A ▲
[11] Ramps enabled, yellow LED
[12] Spool acceleration pot., flow from port P to A or B ▲
[13] Spool deceleration pot., flow from port P to A or B ▲
[14] Monitor point ■, conditioned command signal
[15] Common ground ■, 0V
[16] Monitor point ■, spool position
24V
15V
IMAX.
P
B
A
B
A
t
t

▲ Main-stage spool ■ Ø2(0.0787 dia.) sockets

# Power plugs for proportional valves

EHH-AMP-702-D, 10 series
EHH-AMP-702-E, 10 series



## 1. General description

These plugs, conforming to ISO 4400/ DIN 43650 interface, offer a low-cost control solution for direct solenoid-operated, non-feedback, hydraulic proportional valves through the use of an integral amplifier.

Adjustments of "gain", "ramp time" and "deadband" can be made directly at the plug. Two ranges of ramp times are offered:
- model type D, 10-600 ms.
- model type E, 0,5-5s.

The proportional plug is controlled with a 0-10V command signal to give maximum currents, adjustable with the "gain" control, between 0,5A and 1,8A.

## 2. Features and benefits

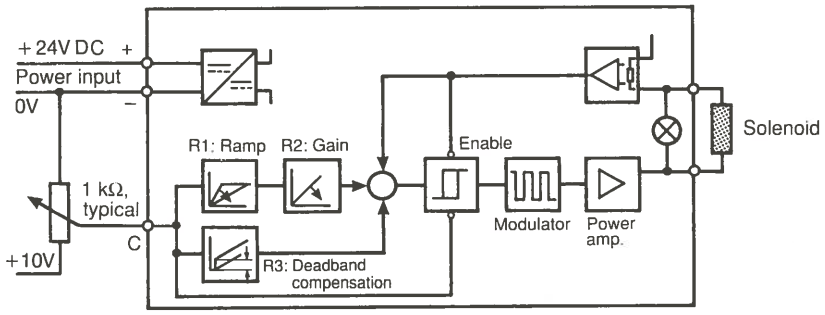
- Integral amplifier provides essential functions for control of proportional valves
- Adjustable ramp time
- Adjustable deadband compensation
- Adjustable gain
- Ease of installation, with reduced cost
- Reduction of EMI radiation
- Fully short-circuit and reverse-polarity protected

## 3. Application

Primary applications are in the control of directly operated, non-feedback proportional valves where the cost of more sophisticated electronic controls can be avoided.

The combination of proportional valve and plug offers very low cost solutions to many hydraulic actuator control problems requiring smooth acceleration and deceleration.

Electrical block function diagram




## 4. Model code

**EHH-AMP-702- * - 1***
[1] [2]

[1] **Adjustment range**
D = Proportional plug: 10 ms to 600 ms
E = Proportional plug: 0,5s to 5s

[2] **Design number, 10 series**
Subject to change: installation dimensions unaltered for design numbers 10 to 19 inclusive.

## 5. Operating data

### 5.1 Electrical

| | |
|---|---|
| Power supply | 20-28V DC: incl. ±10% max. ripple peak-to-peak |
| Protection | IEC 529; IP65 (when correctly installed with interface seal in place) Fully short-circuit and reverse-polarity protected |
| Isolation to VDE 0110 | Group "B" |
| Output current:<br>rated<br>cut-off<br>short-circuit | <br>1,6A<br>3A<br>0,1A rms typical |
| Output voltage | Typically 0,55V below input voltage |
| Max. load impedance at 20V supply voltage | 19 ohms (1,0A)<br>12 ohms (1,6A)<br>9 ohms (2,0A) |
| Command signal:<br>for no output<br>for output | <br>0 to 100 mV<br>200 mV to 10V |
| Input impedance (signal) | 2700 ohms |
| PWM frequency | 400 Hz typical |
| Ramp time:<br>model type **D**<br>model type **E** | <br>10 ms to 600 ms<br>0,5s to 5s |
| Gain | 0,05 A/V to 0,18 A/V |
| Deadband compensation | 0 to 1A |

### 5.2 Mechanical

| | |
|---|---|
| Housing | PA6 glass reinforced plastic (conforming to UL-94HB)<br>Color: gray |
| Mounting interface | ISO 4400 (DIN 43650) |
| Cable clamp | Pg9 screw type |
| Cable diameter | Ø5 to 10 mm (0.197 to 0.394" dia) |
| Wire section | 0,5 to 1,0 $mm^2$ (0.001-0.002 $in^2$)<br>(20AWG-18AWG) |
| Temperature, ambient range | –20 to +70°C (–4 to +158 F) |
| Mass | 0,07 kg (0.154 lb) |

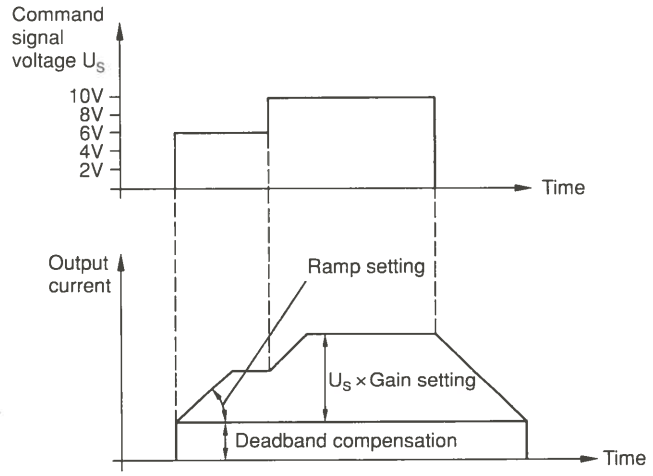
### 5.3 Functions

● Ramp
Ramp time is adjustable by potentiometer R1.

● Gain
Amplifier gain is adjustable by potentiometer R2.

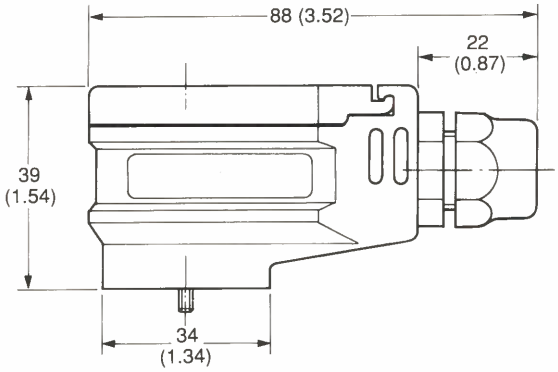
● Deadband compensation
Deadband compensation is adjustable by potentiometer R3, and is switched on at triggering voltage of 200 mV.

Input/output characteristics




## 6. Installation dimensions in mm (inches)

3rd angle projection

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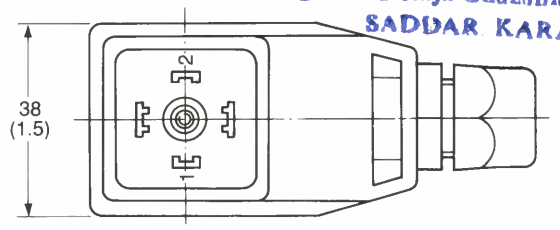



## 7. Installation data

**Commissioning (start-up) procedure**

1. Correctly wire the plug and, before mounting it on the valve solenoid, apply 24V DC (20 to 28V limits) to the "power input" terminal.

2. Check for correct plug function by illumination/non-illumination of the LED: The LED should illuminate when the voltage applied to the "signal input" terminal is more than 100 mV, (max. 10V) and should not be illuminated when the applied voltage is less than 100 mV.

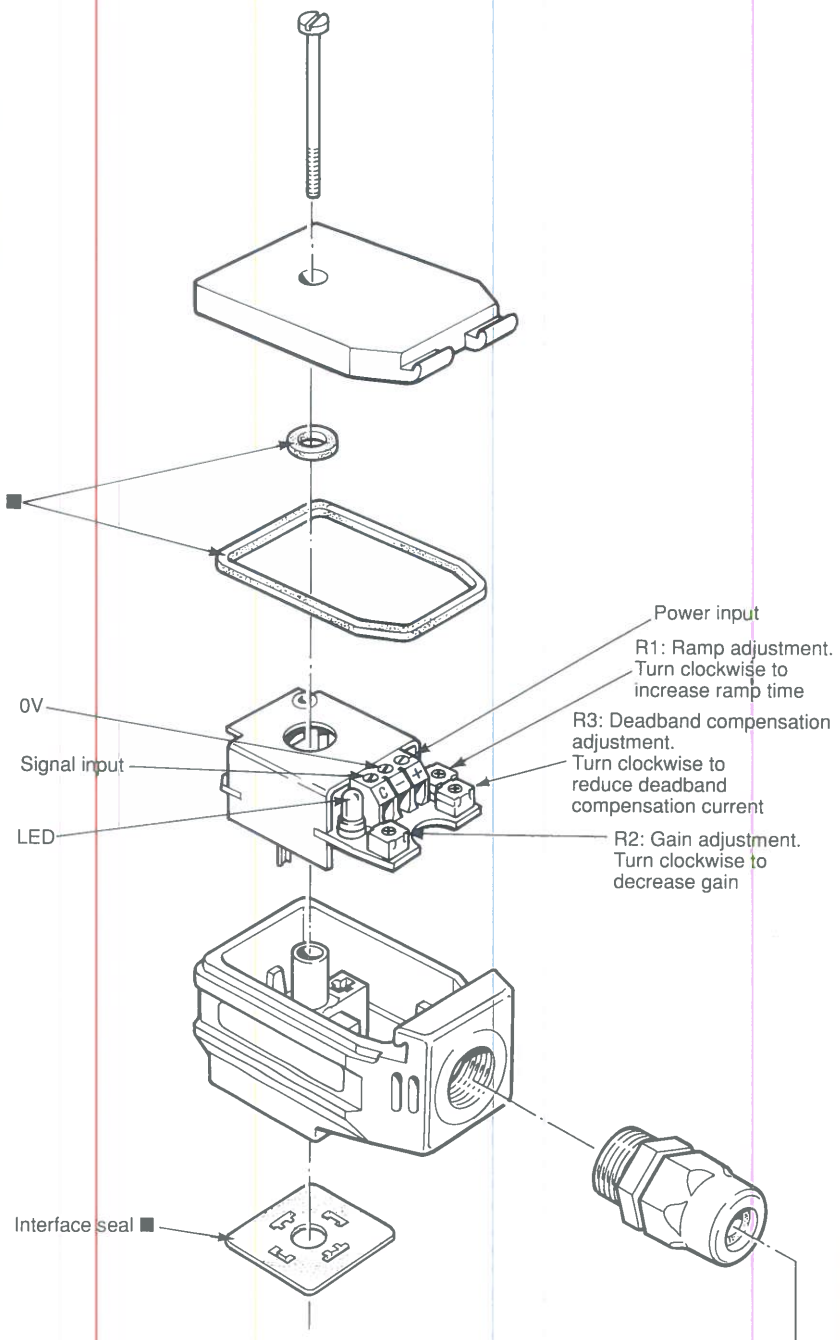
If there is a malfunction a new plug must be fitted.

3. Switch off power supply and command/input signal and then install plug on solenoid. Ensure that all seals are fitted correctly and clamped as the retaining bolt is tightened: *this is essential in providing IP65 protection.*

4. *Ensure that the hydraulic system will not cause any unsafe movement of actuators, then:*
– Switch on power supply again.
– Repeat LED/function check as in 2.
An LED malfunction now indicates a short circuit at the load.

5. Successful completion of these checks means that the plug and load are ready for use.

Assembly showing wiring connection points, LED and adjustment potentiometers

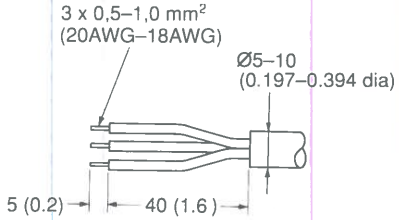

Power input
R1: Ramp adjustment. Turn clockwise to increase ramp time
R3: Deadband compensation adjustment. Turn clockwise to reduce deadband compensation current
R2: Gain adjustment. Turn clockwise to decrease gain
0V
Signal input
LED
Interface seal ■

Warnings

- Ensure cable clamp nut is adequately tightened to secure the cable
- Do not install, or remove, the plug when power is on
- Do not connect, or disconnect, the wiring while power is on

■ All seals must be fitted correctly at plug installation to provide protection to IP65 (IEC 529)

Wiring preparation




## 8. Spare parts

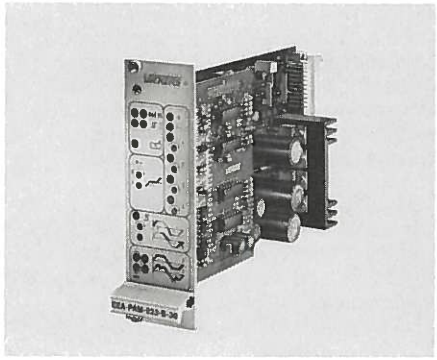
The only spare part available is the interface seal, part number 732100.

## 9. Ordering procedure

Order plug by full model code, and spare interface seals by part number 732100.

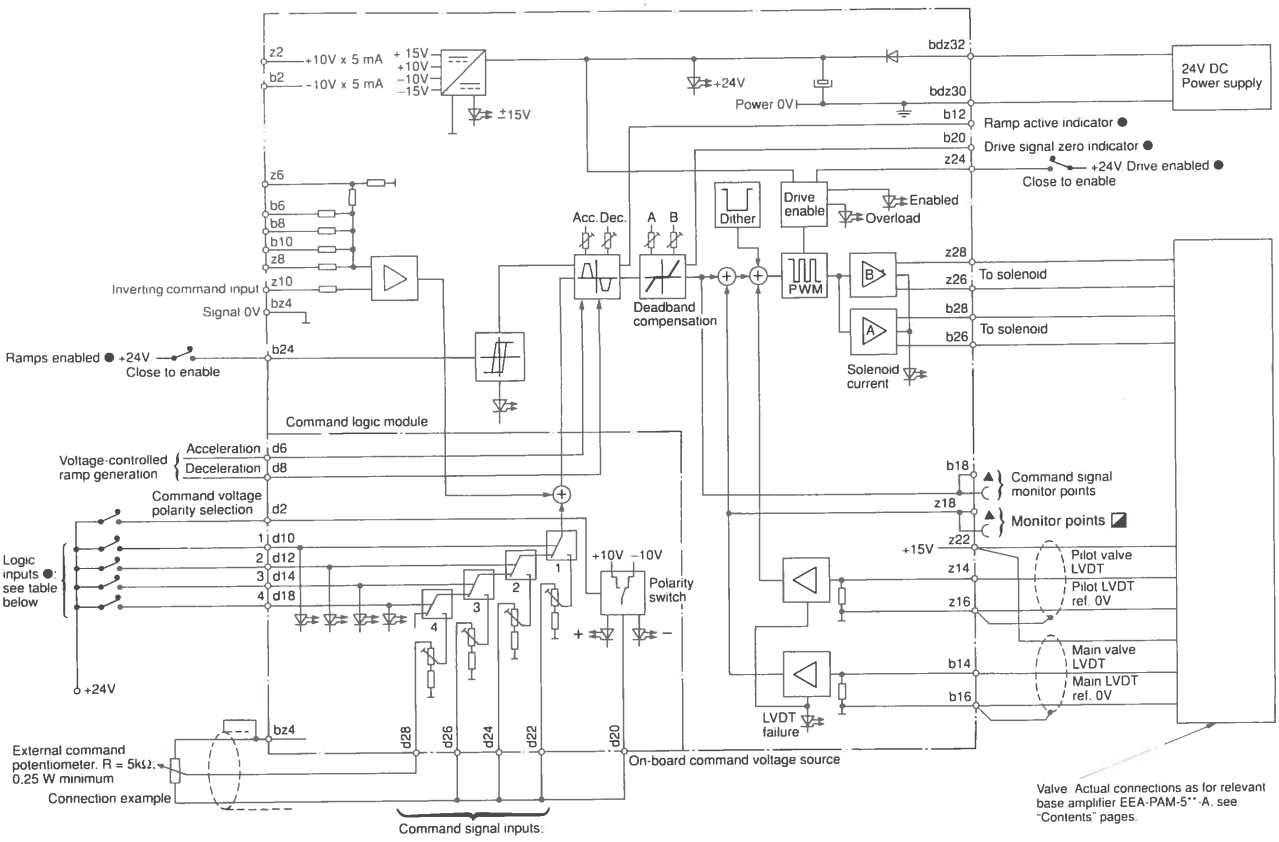
# Power amplifiers

## Models with command logic module and 2 ramps
## EEA-PAM-5**-B-30 series



### 1. Circuit and connections

Shown with command logic module. Individual ramp adjustments of spool acceleration and deceleration, independent of direction of movement, are on the base amplifier. Additionally, acceleration and deceleration can be controlled by variable voltage inputs to pins d6 and d8 respectively. The circuit here includes the essential characteristics of all amplifiers listed in the "Model Codes" section on the next page; actual amplifiers omit certain sub-circuits to those connection pins not needed for the valves concerned.




### Logic selection inputs

| Logic input pin | Command pot. | Secondary pin | Voltage to pin d2 | Valve flow | |
|---|---|---|---|---|---|
| d10 | 1 | bdz30 | 0<br>+24V | P–A<br>P–B | ■ |
| d12 | 2 | bdz30 | 0<br>+24V | P–A<br>P–B | ■ |
| d14 | 3 | bdz30 | 0<br>+24V | P–A<br>P–B | ■ |
| d18 | 4 | bdz30 | 0<br>+24V | P–A<br>P–B | ■ |

■ In the case of EEA-PAM-523/525-B models, one of these relationships may not apply if two single-solenoid valves are connected

◪ Solenoid current for 523/525-B models; LVDT position for all others
▲ On front panel
● See under this heading in "Operating data" table, on next two pages

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## 2. Construction and benefits

Principally, each of these amplifiers is a combination of a base amplifier and a command logic module. Together, they include two-quadrant ramp adjustments and four separately adjustable and selectable command signal inputs.

These pages define the principal characteristics of amplifiers fitted with a particular command logic module; the other characteristics are covered in the pages for the relevant EEA-PAM-5**-A-3* base amplifiers; see "Contents" pages.

Overall dimensions are within the installation envelopes of the base amplifiers.

**Benefits**

- Designed to minimize the amount of external wiring and the space required in the rack enclosure. Only one 24V power supply is needed.
- Provides four on-board command signal potentiometers selectable by 24V DC on-off signals which can, alternatively, be used to limit the adjustment ranges of external command signal potentiometers.
- Ramp times set by the front-panel potentiometers can be varied remotely by applying suitable voltages at pin d6 or d8, as required.
- The polarity of the 10V reference voltage can be changed by a polarity-change relay which switches the direction of spool movement.

## 3. Model codes

| Amplifier model | For valves |
|---|---|
| EEA-PAM-523-B-3* | K*G4V-3 . . . . . -H7-2* |
| EEA-PAM-525-B-3* | K*G4V-5 . . . . . -H*-3* |
| EEA-PAM-533-B-3* | KF*G4V-3 |
| EEA-PAM-535-B-3* | KF*G4V-5 |
| EEA-PAM-561-B-3* | KFDG5V-5/7 |
| EEA-PAM-568-B-3* | KFDG5V-8 |
| EEA-PAM-581-B-3* | KHDG5V-5/7/8 |

## 4. Operating data

| | |
|---|---|
| Power requirements | 24V DC nominal x 40W<br>Maximum voltage range = 20-40V (including ripple)<br>Maximum ripple = ±10% pk.-to-pk.<br>Amplifier shuts down below 18V DC.<br>Reverse-polarity-protected. |
| Output voltages, for control:<br>At pin z2<br>At pin b2<br>At pins z2 and b2 | <br>+10V (±1%) x 5 mA<br>–10V (±1%) x 5 mA<br>Ripple <20 mV pk.-to-pk.<br>Temperature drift <1 mV/°C (<0,5 mV/°F) thru' 0-60°C (32-140°F) range<br>All outputs short-circuit protected |
| Command signal inputs:<br>Direct-voltage pins<br>Inverting-voltage pin<br>Current pin<br>Voltage range<br>Input impedance (voltage)<br>Current range<br>Input impedance (current) | <br>b8, b6, z8, b10<br>z10<br>z6<br>±10V<br>47 kΩ<br>±20 mA<br>100Ω |
| Command voltage source, d20 | ±10V x 10 mA |
| Command voltage polarity selection:<br>For flow from (main) port P to A<br>For flow from (main) port P to B<br>Input impedance | <br>Pin d2 at 0 to +5V<br>Pin d2 at +10 to +40V<br>47 kΩ |
| Logic inputs:<br>Switch-on voltage<br>Switch-off voltage<br>Input current, d10, d12, d14 or d18 | <br>+10 to +40V<br><+5V<br>≤10 mA |
| Command voltage inputs:<br>Input pins<br>Voltage and source<br><br>Input impedance, d22, d24, d26 and d28<br>External command potentiometer | <br>d22, d24, d26 and d28.<br>+10V gives valve flow from port P to B, or –10V gives flow from P to A.<br>Four 50 kΩ pots.<br>5 kΩ; 0,25W minimum.<br>Part no. 714127; see "Contents" pages for the "Electronic accessories". |

*Continued on next page*

| | |
|---|---|
| Voltage-controlled ramp generator:<br>Acceleration pin d6<br>Deceleration pin d8<br><br><br><br><br><br><br>Input impedance, d6 or d8 | <br>±10V<br>±10V<br>Note: At any ramp pot. setting, positive voltages increase ramp times and negative voltages decrease them.<br>With pot. set at zero, 0 to +10V equates to a ramp time range of 50 ms to 5s.<br>With pot. set at max., 0 to –10V equates to a ramp time range of 5s to 50 ms.<br>47 kΩ |
| Drive enabled (power available to solenoid) | Apply >9,8V to <40V at z24 (22 kΩ) |
| Drive disabled (no power to solenoid) | Apply open circuit or up to 4,5V at z24 |
| Ramps enabled (valve switching rate limited by ramp potentiometers) | Apply >9,8V to <40V to b24 (22 kΩ) |
| Ramps disabled (fastest valve switching; ramp circuit bypassed) | Apply open circuit or up to 4,5V to b24 |
| Ambient temperature range | 0 to 60°C (32 to 140°F) |
| Storage temperature range | –25 to +85°C (–12 to +185°F) |
| Edge connectors | DIN 41612 F48 male type on the board. Mating connector must be an F48 female type. |
| Installation dimensions and panel display | Dimensions are the same as for the corresponding base amplifier but the panel display is different; see next page. |
| Mass | 0,40 kg (0.88 lb) approx. |
| Other characteristics | See "Contents" pages for the relevant base amplifier EEA-PAM-5**-**A**-3* |
| Installation and commissioning (start-up) | See "Contents" pages |
| Supporting products:<br>Power unit options<br>Electronic accessories<br>Portable test equipment | See "Contents" pages |

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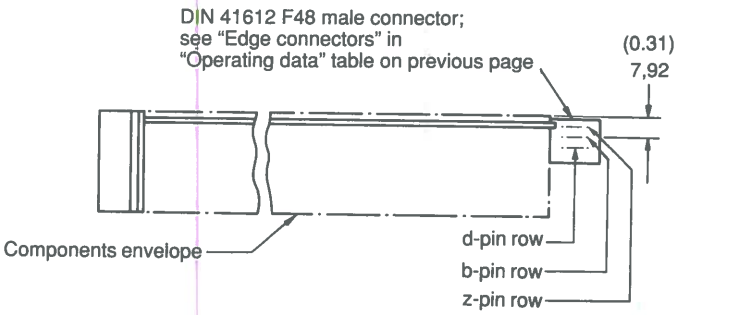
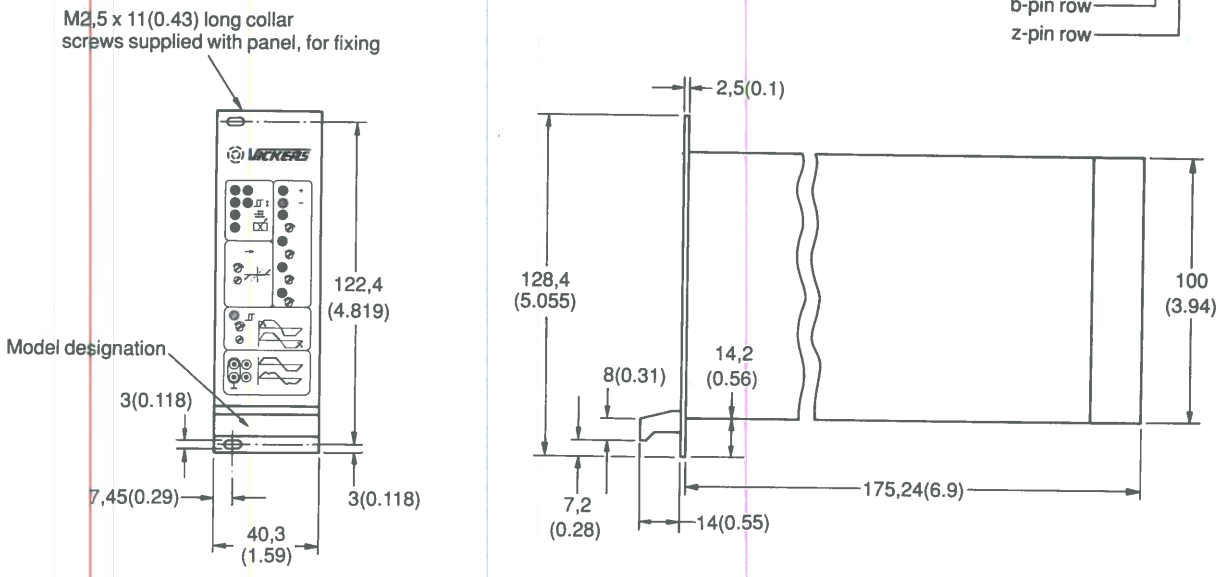
## 5. Installation dimensions, in mm (inches)

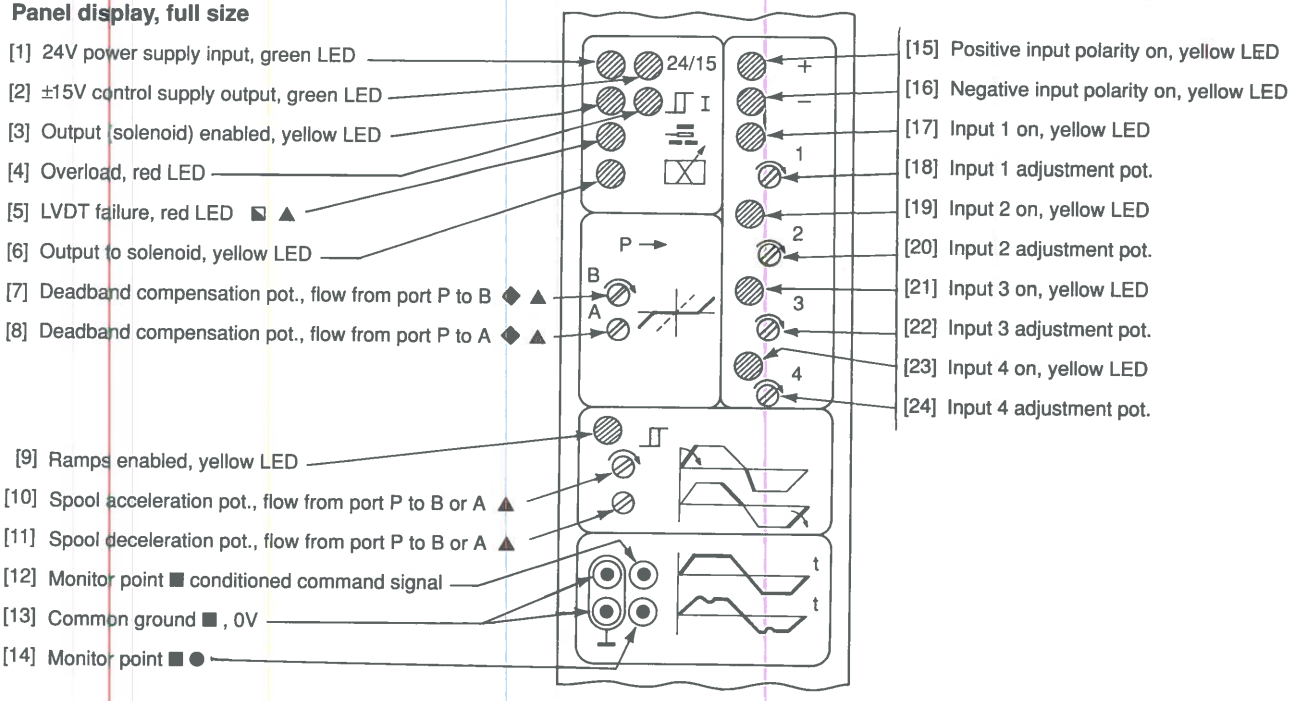
**Plug-in unit of 3U height, to IEC 297**

3rd angle projection




### Panel display, full size


[1] 24V power supply input, green LED
[2] ±15V control supply output, green LED
[3] Output (solenoid) enabled, yellow LED
[4] Overload, red LED
[5] LVDT failure, red LED ◪ ▲
[6] Output to solenoid, yellow LED
[7] Deadband compensation pot., flow from port P to B ◆ ▲
[8] Deadband compensation pot., flow from port P to A ◆ ▲
[9] Ramps enabled, yellow LED
[10] Spool acceleration pot., flow from port P to B or A ▲
[11] Spool deceleration pot., flow from port P to B or A ▲
[12] Monitor point ■ conditioned command signal
[13] Common ground ■ , 0V
[14] Monitor point ■ ●
24/15
P
B
A
+
−
1
2
3
4
t
t
[15] Positive input polarity on, yellow LED
[16] Negative input polarity on, yellow LED
[17] Input 1 on, yellow LED
[18] Input 1 adjustment pot.
[19] Input 2 on, yellow LED
[20] Input 2 adjustment pot.
[21] Input 3 on, yellow LED
[22] Input 3 adjustment pot.
[23] Input 4 on, yellow LED
[24] Input 4 adjustment pot.

◪ LED and symbol not on EEA-PAM-523/525 amplifiers.

▲ Main-stage spool in the case of K*DG5V valves.

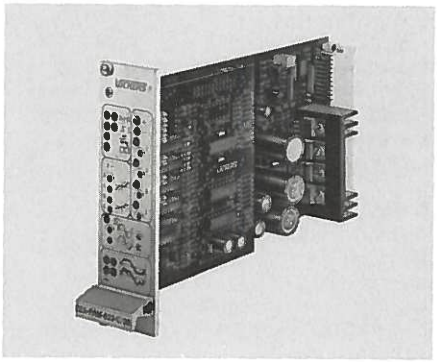
◆ In the case of EEA-PAM-523/525 amplifiers, one of these relationships may not apply if two single-solenoid valves are connected.

● Of solenoid current in the case of EEA-PAM-523/525 models, of spool position for others.

■ Ø2,0 (0.0787 dia.) sockets

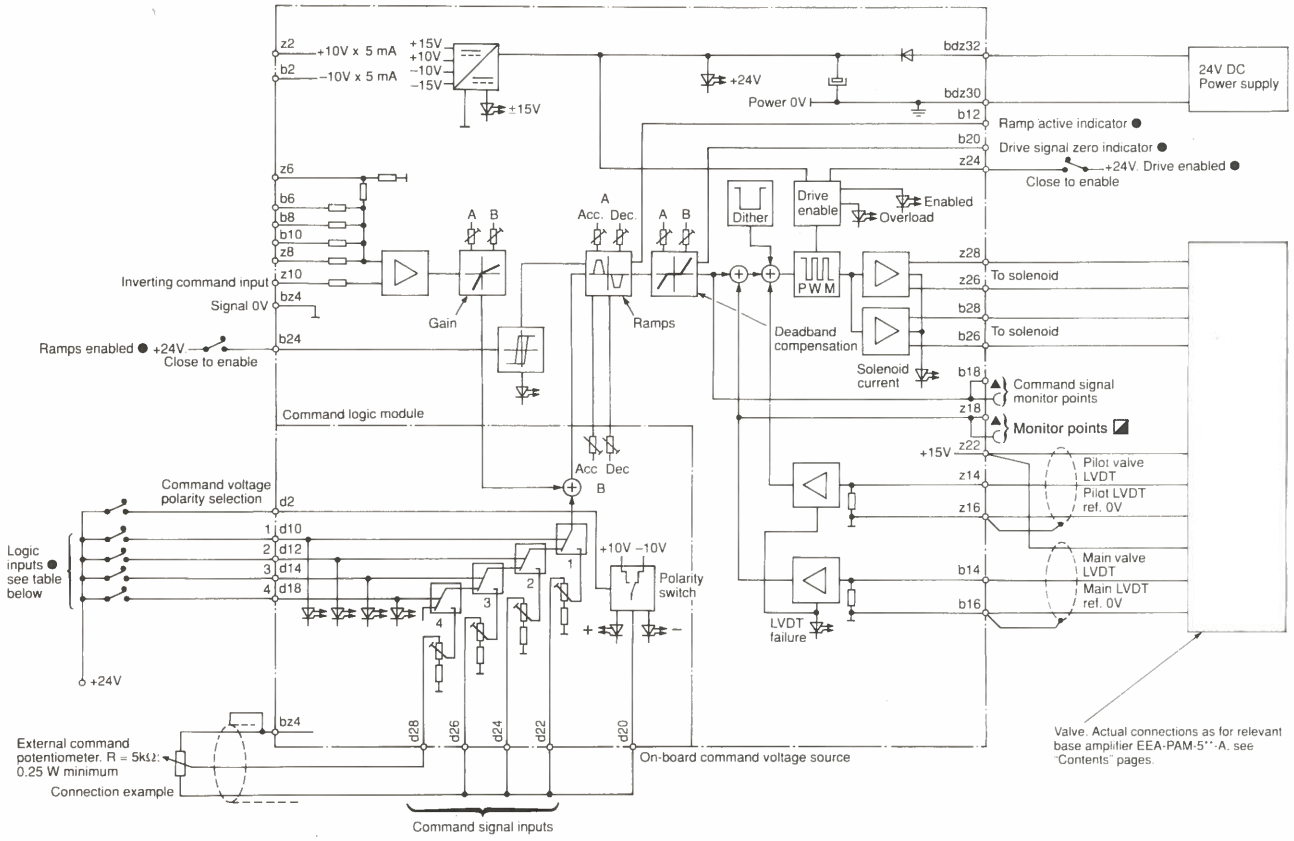
# Power amplifiers

Models with command logic module and 4 ramps
EEA-PAM-5**-C-3* series



## 1. Circuit and connections

Shown with command logic module. Individual ramp adjustments of spool acceleration and deceleration for each direction of movement, are on the base amplifier. The circuit here includes the essential characteristics of all amplifiers listed in the "Model Codes" section on the next page; actual amplifiers omit certain sub-circuits to those connection pins not needed for the valves concerned.




### Logic selection inputs

| Logic input pin | Command pot. | Secondary pin | Voltage to pin d2 | Valve flow | |
|---|---|---|---|---|---|
| d10 | 1 | bdz30 | 0<br>+24V | P–A<br>P–B | ■ |
| d12 | 2 | bdz30 | 0<br>+24V | P–A<br>P–B | ■ |
| d14 | 3 | bdz30 | 0<br>+24V | P–A<br>P–B | ■ |
| d18 | 4 | bdz30 | 0<br>+24V | P–A<br>P–B | ■ |

■ In the case of EEA-PAM-523/525-C models, one of these relationships may not apply if two single-solenoid valves are connected

◪ Solenoid current for 523/525-C models; LVDT position for all others
▲ On front panel
● See under this heading in "Operating data" table, on next two pages

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## 2. Construction and benefits

Principally, each of these amplifiers is a combination of a base amplifier and a command logic module. Together, they include four-quadrant ramp adjustments and four separately adjustable and selectable command signal inputs.

These pages define the principal characteristics of amplifiers fitted with a particular command logic module; the other characteristics are covered in the pages for the relevant EEA-PAM-5**-A-3* base amplifiers; see "Contents" pages.

Overall dimensions are within the installation envelopes of the base amplifiers.

**Benefits**

- Designed to minimize the amount of external wiring and the space required in the rack enclosure. Only one 24V power supply is needed.
- Provides four on-board command signal potentiometers selectable by 24V DC on-off signals which can, alternatively, be used to limit the adjustment ranges of external command signal potentiometers.
- Four separately adjustable ramps with quadrant recognition.
- The polarity of the 10V reference voltage can be changed by a polarity-change relay which switches the direction of spool movement.

## 3. Model codes

| Amplifier model | For valves |
|---|---|
| EEA-PAM-523-C-3* | K*G4V-3 . . . . . -H7-2* |
| EEA-PAM-525-C-3* | K*G4V-5 . . . . . -H*-3* |
| EEA-PAM-533-C-3* | KF*G4V-3 |
| EEA-PAM-535-C-3* | KF*G4V-5 |
| EEA-PAM-561-C-3* | KFDG5V-5/7 |
| EEA-PAM-568-C-3* | KFDG5V-8 |
| EEA-PAM-581-C-3* | KHDG5V-5/7/8 |

## 4. Operating data

| | |
|---|---|
| Power requirements | 24V DC nominal x 40W<br>Maximum voltage range = 20-40V (including ripple)<br>Maximum ripple = ±10% pk.-to-pk.<br>Amplifier shuts down below 18V DC.<br>Reverse-polarity-protected. |
| Output voltages, for control:<br>At pin z2<br>At pin b2<br>At pins z2 and b2 | <br>+10V (±1%) x 5 mA<br>–10V (±1%) x 5 mA<br>Ripple <20 mV pk.-to-pk.<br>Temperature drift <1 mV/°C (<0,5 mV/°F) thru' 0-60°C (32-140°F) range<br>All outputs short-circuit protected |
| Command signal inputs:<br>Direct-voltage pins<br>Inverting-voltage pin<br>Current pin<br>Voltage range<br>Input impedance (voltage)<br>Current range<br>Input impedance (current) | <br>b8, b6, z8, b10<br>z10<br>z6<br>±10V<br>47 kΩ<br>±20 mA<br>100Ω |
| Command voltage source, d20 | ±10V x 10 mA |
| Command voltage polarity selection:<br>For flow from (main) port P to A ▲<br>For flow from (main) port P to B ▲<br>Input impedance | <br>Pin d2 at 0 to +5V<br>Pin d2 at +10 to +40V<br>47 kΩ |
| Logic inputs:<br>Switch-on voltage<br>Switch-off voltage<br>Input current, d10, d12, d14 or d18 | <br>+10 to +40V<br><+5V<br>≤10 mA |
| Command voltage inputs:<br>Input pins<br>Voltage and source<br><br><br>Input impedance, d22, d24, d26 and d28<br>External command potentiometer | <br>d22, d24, d26 and d28.<br>+10V gives valve flow from port P to B, or –10V gives flow from P to A.<br>Four 50 kΩ pots.<br>5 kΩ; 0,25W minimum.<br>Part no. 714127; see "Contents" pages for the "Electronic accessories". |

▲ In the case of EEA-PAM-523/525 amplifiers, one of these relationships may not apply if two single-solenoid valves are connected.

*Continued on next page*

| | |
|---|---|
| Drive enabled (power available to solenoid) | Apply >9,8V to <40V at z24 (22 kΩ) |
| Drive disabled (no power to solenoid) | Apply open circuit or up to 4,5V at z24 |
| Ramps enabled (valve switching rate limited by ramp potentiometers) | Apply >9,8V to <40V to b24 (22 kΩ) |
| Ramps disabled (fastest valve switching; ramp circuit bypassed) | Apply open circuit or up to 4,5V to b24 |
| Ambient temperature range | 0 to 60°C (32 to 140°F) |
| Storage temperature range | –25 to +85°C (–12 to +185°F) |
| Edge connectors | DIN 41612 F48 male type on the board. Mating connector must be an F48 female type. |
| Installation dimensions and panel display | Dimensions are the same as for the corresponding base amplifier but the panel display is different; see next page. |
| Mass | 0,40 kg (0.88 lb) approx. |
| Other characteristics | See "Contents" pages for the relevant base amplifier EEA-PAM-5**-**A**-3*. |
| Installation and commissioning (start-up) | See "Contents" pages |
| Supporting products:<br>Power unit options<br>Electronic accessories<br>Portable test equipment | See "Contents" pages |

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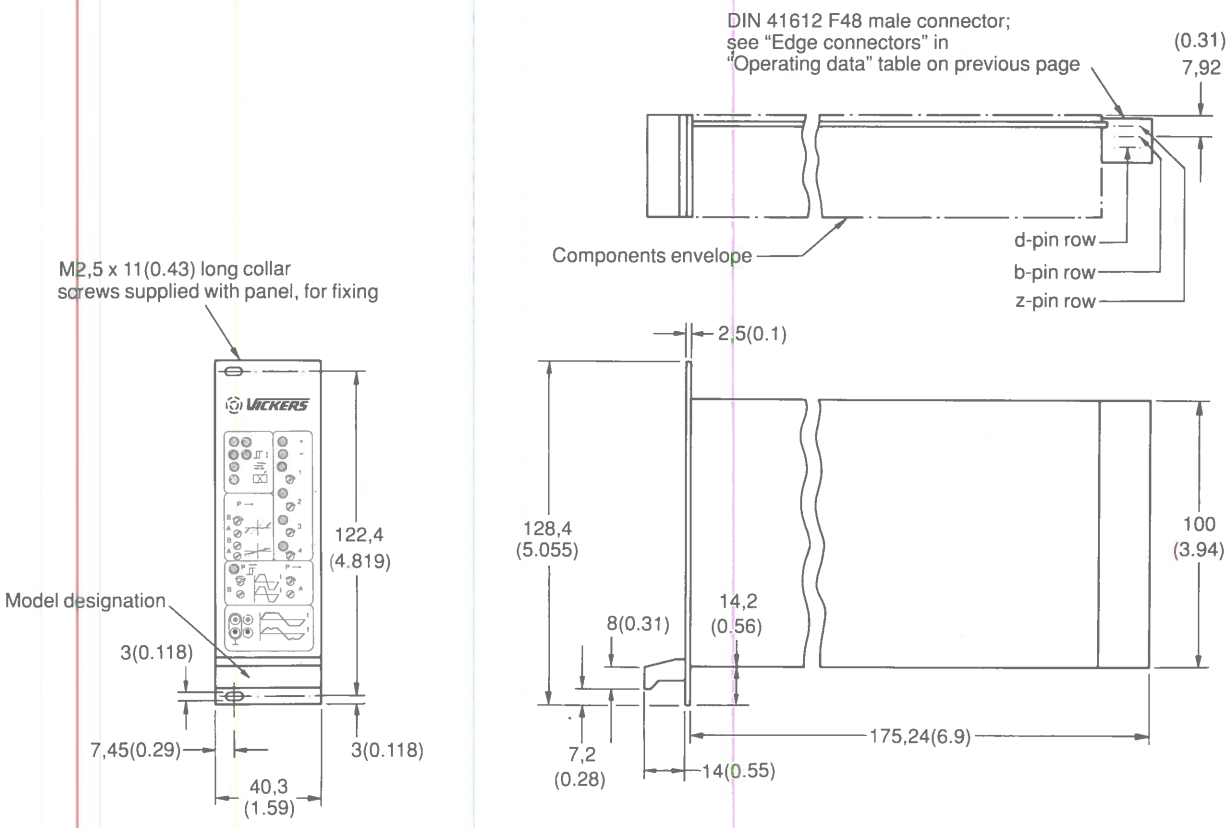
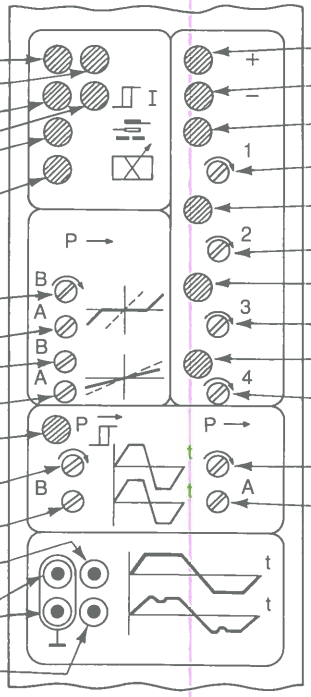
## 5. Installation dimensions, in mm (inches)

**Plug-in unit of 3U height, to IEC 297**

3rd angle projection




### Panel display, full size




[1] 24V power supply input, green LED

[2] ±15V control supply output, green LED

[3] Drive (solenoid) enabled, yellow LED

[4] Overload, red LED

[5] LVDT failure, red LED ◹ ▲

[6] Drive to solenoid, yellow LED ◒

[7] Deadband compensation pot., flow from port P to B ◆ ▲

[8] Deadband compensation pot., flow from port P to A ◆ ▲

[9] Gain pot., flow from port P to B ⬓ ▲

[10] Gain pot., flow from port P to A ⬓ ▲

[11] Ramps enabled, yellow LED

[12] Spool acceleration pot., flow from port P to B ▲†

[13] Spool deceleration pot., flow from port P to B ▲ △

[14] Monitor point ■ conditioned command signal

[15] Common ground ■ , 0V

[16] Monitor point ■ ▲ ●

[17] Positive input polarity on, yellow LED

[18] Negative input polarity on, yellow LED

[19] Input 1 on, yellow LED

[20] Input 1 adjustment pot.

[21] Input 2 on, yellow LED

[22] Input 2 adjustment pot.

[23] Input 3 on, yellow LED

[24] Input 3 adjustment pot.

[25] Input 4 on, yellow LED

[26] Input 4 adjustment pot.

[27] Spool acceleration pot., flow from port P to A, † ▲

[28] Spool deceleration pot., flow from port P to A, △ ▲

◹ LED and symbol not on EEA-PAM-523/525 amplifiers.

▲ Main-stage spool in the case of K*DG5V valves.

● Of solenoid current in the case of EEA-PAM-523/525 models, of spool position for others.

■ Ø2,0 (0.0787 dia.) sockets

◒ Indicates output to which ever solenoid is energized

◆ In the case of EEA-PAM-523/525 amplifiers, one of these relationships may not apply if two single-solenoid valves are connected

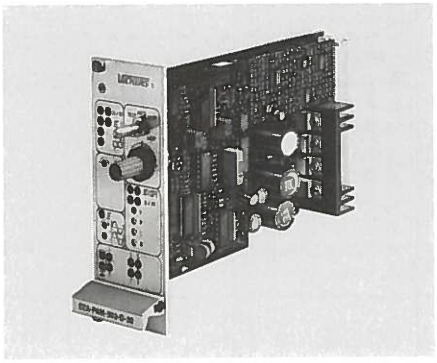
⬓ In the case of EEA-PAM-523/525 amplifiers, one of these relationships may not apply if two single-solenoid valves are connected

† In the case of EEA-PAM-523/525 amplifiers, one of these relationships may not apply if two single-solenoid valves are connected

△ In the case of EEA-PAM-523/525 amplifiers, one of these relationships may not apply if two single-solenoid valves are connected

# Power amplifiers with PID modules

EEA-PAM-5**-D-30 series



## 1. General description

The EEA-PAM-5**-D-30 Eurocards are power amplifiers with integrated PID modules. Each of these cards replaces two conventional electronic cards.

**Features and benefits:**

- The design reduces the amount of external wiring, saves space in the rack enclosure and requires only one 24V power supply.
- The general purpose, integrated module can be configured using DIL switches (D1-D8) and potentiometers for the following applications:
  - Closed-loop pressure control using either proportional pressure valves or servo performance proportional valves.
  - Closed-loop velocity control.
  - Closed-loop position control.
  - p/Q control with internal or external switch-over from C[illegible].
- The DIL-switch and potentiometer settings can easily be reconfigured on different cards.
- A built-in test function significantly simplifies commissioning (start-up) and fault-diagnosis.

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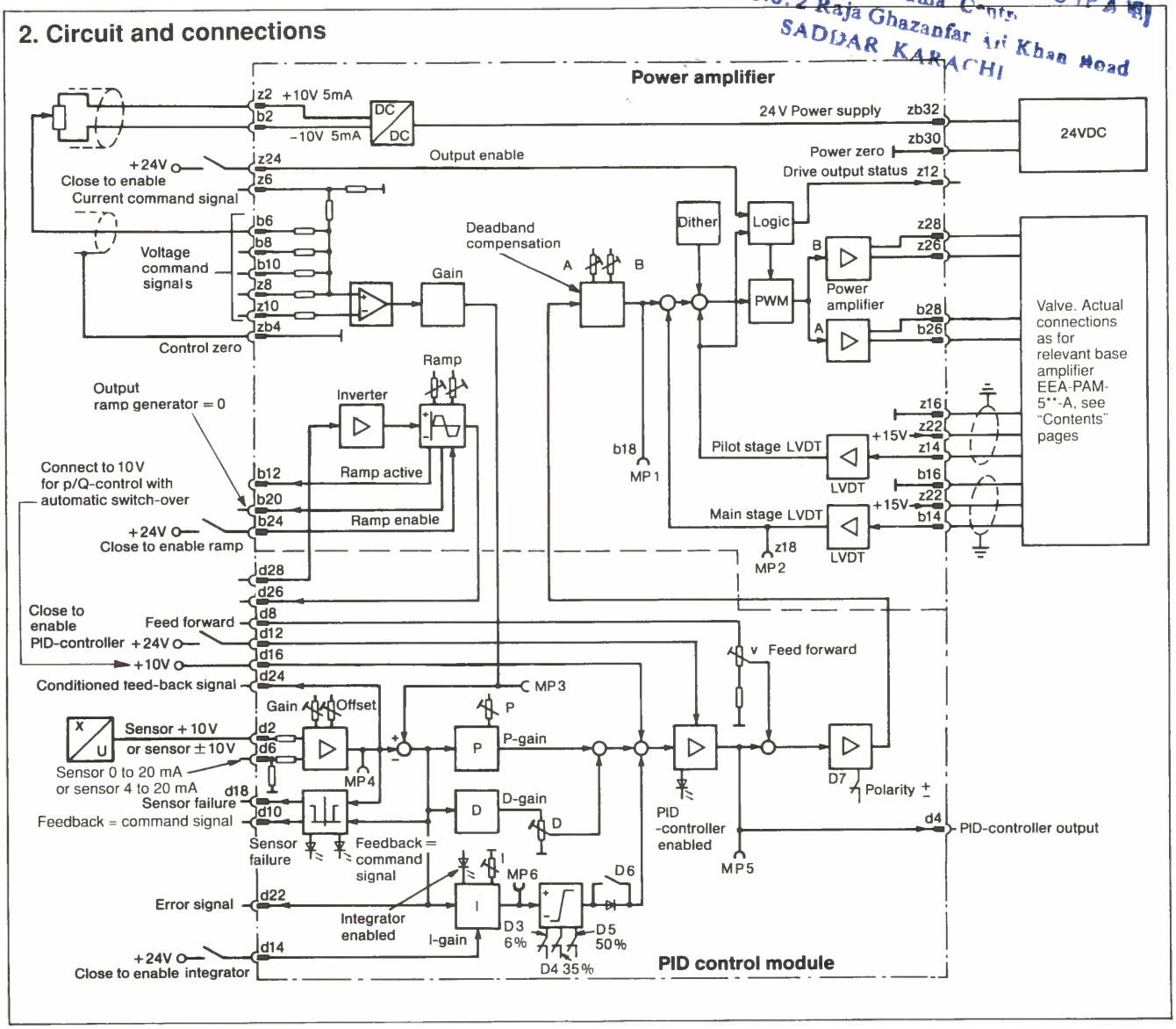
## 2. Circuit and connections



## 3. Model codes

| Amplifier | For valve |
|---|---|
| EEA-PAM-523-D-3* | K*G4V-3----H7 |
| EEA-PAM-525-D-3* | K*G4V-5----H* |
| EEA-PAM-533-D-3* | KF*G4V-3 |
| EEA-PAM-535-D-3* | KF*G4V-5 |
| EEA-PAM-553-D-3* | KSDG4V-3 |
| EEA-PAM-561-D-3* | KFDG5V-5/7 |
| EEA-PAM-568-D-3* | KFDG5V-8 |
| EEA-PAM-581-D-3* | KHDG5V-5/7/8 |

## 4. Operating data

| | | |
|---|---|---|
| Power (input) supply | bz32 | 24V DC nominal x 40W<br>Maximum voltage range:<br>20-40V (including ripple)<br>Maximum ripple: ±10% pk.-to-pk.<br>Amplifier shuts down below<br>18V DC.<br>Reverse-polarity protected. |
| Control (output) supplies | z22, b22 | Not available for external use |
| Reference voltages | z2<br>b2 | +10V, 5 mA<br>–10V, 5 mA |
| Analog inputs: | | |
| Command inputs | | |
| Direct voltage inputs | b6, b8, b10, z8 | |
| Inverting voltage input | z10 | |
| Voltage range | | ±10V |
| Input impedance (voltage) | | 47 kΩ |
| Current input | z6 | |
| Current range | | ±20 mA |
| Input impedance (current) | | 100 Ω |
| Feed forward input | d8 | |
| Input impedance | | 6 kΩ |
| Voltage range | | ±10V |
| Input ramp | d28 | |
| Input impedance | | 10 kΩ |
| Voltage range | | ±10V |
| Sensor inputs | | |
| Voltage input | d2 | |
| Input impedance | | 1 MΩ |
| Voltage range | | ±10V |
| Current input | d6 | |
| Input impedance | | 100 Ω |
| Current range | | 20 mA |
| (See "6.1, DIL switches");<br>Monitoring of sensor failure for sensors with a current output only (4 to 20 mA) | | |
| Digital inputs: | | |
| Drive enable (power available to solenoid) | z24 | |
| Ramps enable | b24 | |
| Integrator enable | d14 | |
| PID-controller enable | d12 | |
| Enabled | | 17 to 40V |
| Disabled | | 0 to 3,5V |
| Load current | | ≤10 mA |

*Continued on next page*

| | | |
|---|---|---|
| Digital outputs: | | |
| Sensor failure | d18 | |
| Sensor failure | | Vcc–2V |
| Sensor o.k. | | <3V |
| Load current (continuous-short-circuit proof) | | ≤100 mA |
| This output may be used only in conjunction with sensors providing a current output (4-20 mA) | | |
| Feedback = command signal | d10 | |
| Feedback matches demand | | Vcc–2V |
| Feedback does not match demand | | <3V |
| Load current (continuous-short-circuit proof) | | ≤100 mA |
| The load at pin d18 and pin d10 has to be connected to ground. | | |
| Analog outputs: | | |
| PID-controller output | d4 | |
| Error signal | d22 | |
| Feedback signal | d24 | |
| Load impedance | | ≤10 kΩ; short-circuit proof |
| Voltage range | | ±10V |
| Output ramp generator | d26 | |
| Load resistance | | ≤5 kΩ; short-circuit proof |
| Voltage range | | ±10V |
| Potentiometers: | | |
| Feed forward | | V = 20% to 100% |
| P-gain (depends on DIL switch D2): | | P = 0.1 to 50 |
| I-gain | | I = 2% to 100% |
| D-gain | | D = 0 to 100% |
| Monitor points: | | |
| Conditioned command signal | MP1 | |
| LVDT (spool) position | MP2 | |
| Command signal | MP3 | |
| Feedback signal | MP4 | |
| PID-controller output | MP5 | |
| Integrator output (100%, independent of D3, D4, D5) | MP6 | |
| Voltage range | | ±10V |
| Monitor point impedance | | 10 kΩ |
| Ambient conditions: | | |
| Storage temperature range | | –25 to 85°C (–13 to 185°F) |
| Operating temperature range | | 0 to 60°C (32 to 140°F) |
| Installation dimensions and panel display | | See next page |
| Coding pin hole location | | As for relevant base amplifier EEA-PAM-5**-A-3* |
| Mass | | 0,4 kg (0.88 lb) approx. |
| Installation and commissioning (start-up) | | See “Contents” pages |
| Supporting products: | | See “Contents” pages |
| Power supply unit options | | |
| Electronic accessories | | |
| Portable test equipment | | |

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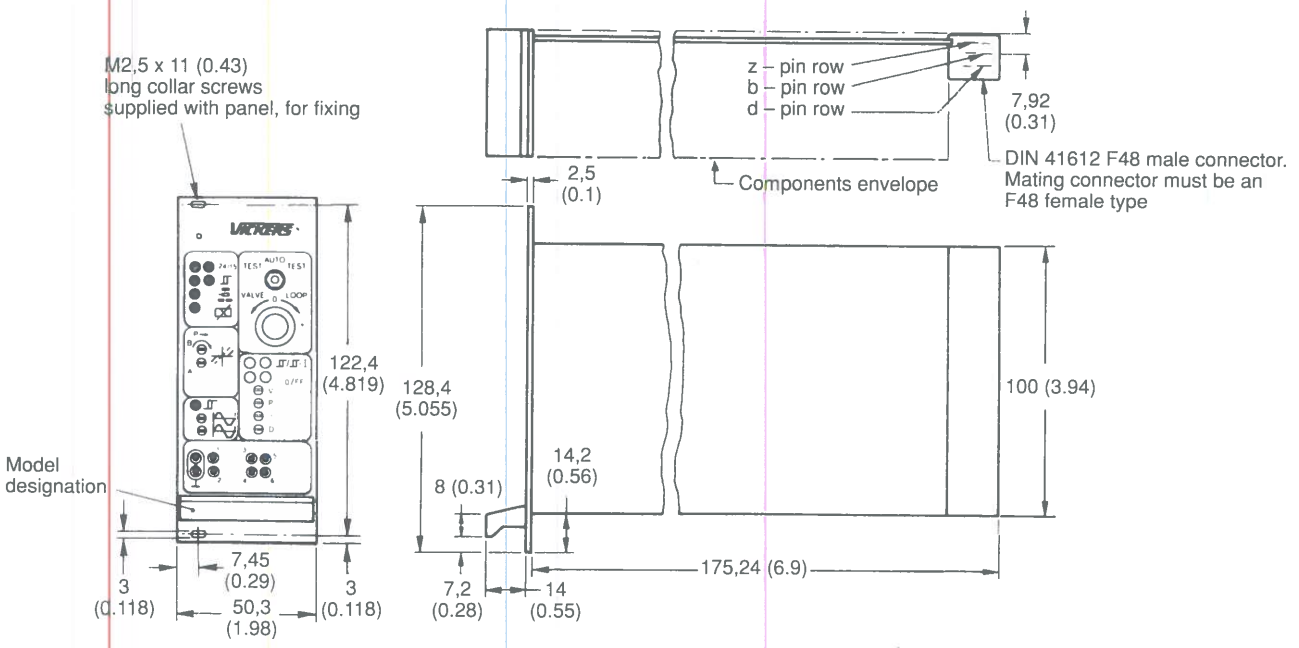
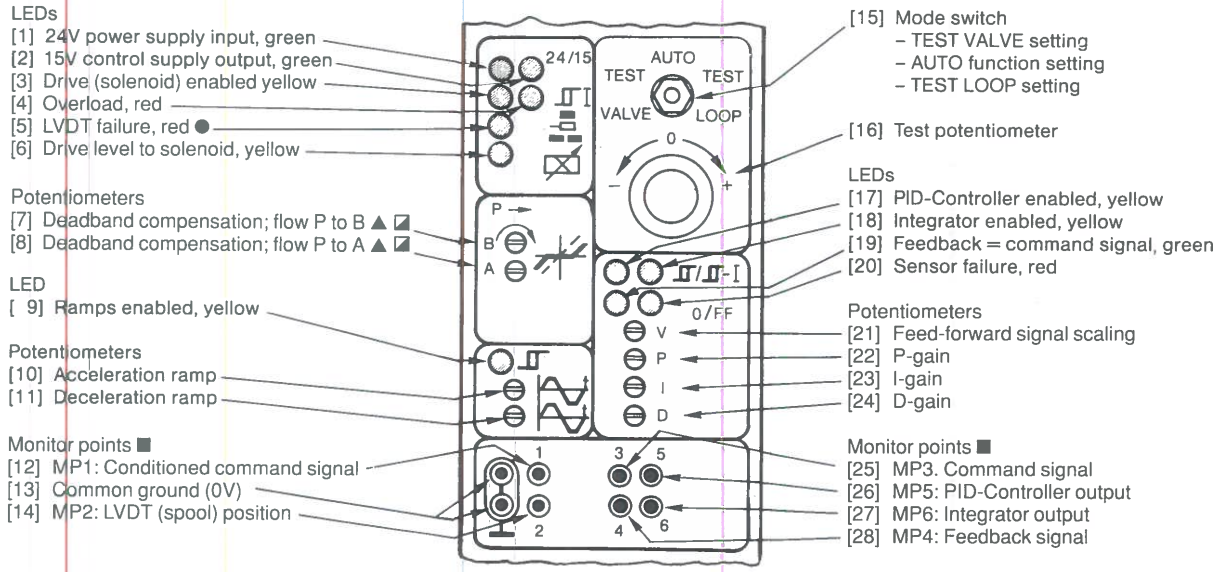
## 5. Installation dimensions in mm (inches)

**Plug-in unit of 3U height, to IEC 297**

3rd angle projection




### Panel display




▲ All amplifiers except EEA-PAM-541/553 models, for which potentiometer [7] is as below, [8] being omitted.

[7] Offset

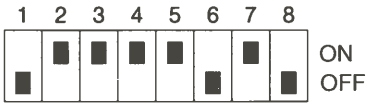
■ Ø2 (0.0787 dia) sockets

◪ In the case of EEA-PAM-523/525-D models, one of these relationships may not apply if two single-solenoid valves are connected

## 6. Application notes

### 6.1 DIL switches

The controller is configured for the application using DIL switches, located on the board.




Factory setting

The DIL switches operate as follows:

| Switch | ON | OFF |
|---|---|---|
| D1: | For sensors with 4 to 20 mA output | For sensors with ±10V or 20 mA outputs |
| D2: | P-gain 2 to 50 | P-gain 0.1 to 2 |
| D6: | One-sided limitation of the integrator ouput. (Only useful for proportional pressure and proportional throttle valves.) | No limitations of integrator output |
| D7: | Inverts the controller output signal. | Non-inverted signal |
| D8: | For sensors with 4 to 20 mA output | For sensors with ±10% or 20 mA outputs |

For p/Q control with internal switch-over d16 has to be connected to z2.

The switches D3, D4, and D5 belong together. They limit the I-gain between 5% and 100% as follows:

| D3 | D4 | D5 | I-gain |
|---|---|---|---|
| ON | ON | ON | 100% |
| ON | ON | OFF | 50% |
| ON | OFF | ON | 35% |
| ON | OFF | OFF | 25% |
| OFF | ON | ON | 5,9% |
| OFF | ON | OFF | 5,8% |
| OFF | OFF | ON | 5,3% |
| OFF | OFF | OFF | 5,0% |

### 6.2 Reconfiguration of controller parameters

Once the controller parameters have been optimized and set, they can be measured by means of an ohmmeter. This allows easy reconfiguration of the controller on different cards for use as spare parts or on standard machine series.

Three test points are located on the PID-module for this purpose. The resistance between the appropriate test point and ground (at the front panel monitor point) determines the controller parameters:

TP1 (X21): I-gain
TP2 (X14): P-gain
TP3 (X15): D-gain

### 6.3 Operation of the integrated test mode

The basic operation of the hydraulic actuator can be tested by using the 3-position mode switch mounted on the front panel. To select different modes the toggle switch must be lifted slightly before turning it to a new position.

**Caution:**
Before setting the mode switch to either "Test valve" or "Test loop" make sure the test potentiometer is set to "0". Otherwise sudden movements of the actuator may occur.

The mode switch has three positions:
"AUTO"
The controller operates in closed-loop mode, using the external command signal. The test potentiometer is disconnected.

"TEST VALVE"
An open-loop command signal for the valve comes directly from the potentiometer. The external input signal is disconnected. The hydraulic part of the system may be tested in this configuration.

"TEST LOOP"
The command signal for the PID-controller comes directly from the potentiometer. The external signal input is disconnected. This configuration allows for verification of the valve polarity and the control parameters.

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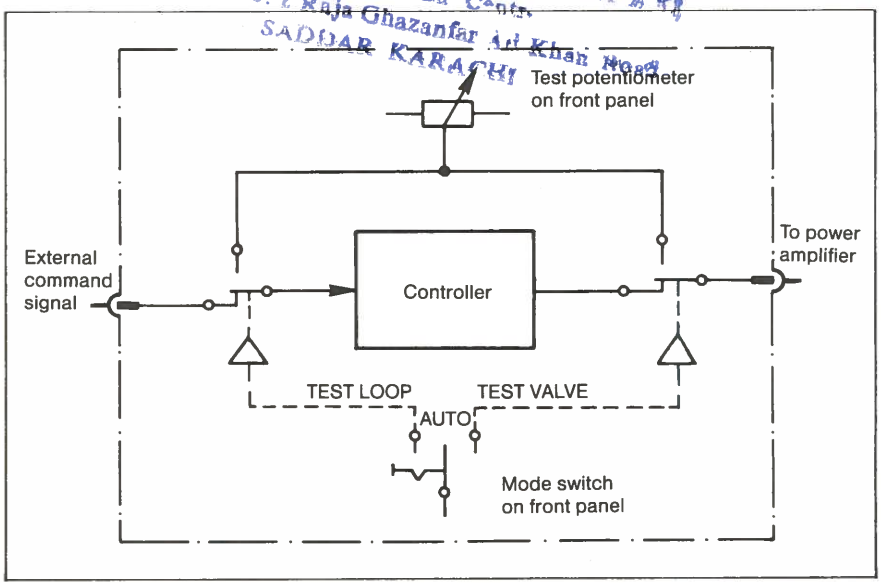
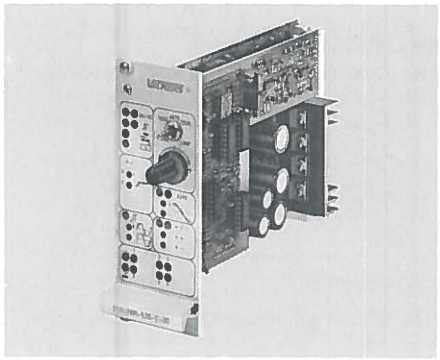


# Power amplifiers with strip guidance controller modules

EEA-PAM-5**-E-30 series



## 1. General description

A strip guidance controller serves to control the position of an electrohydraulic actuator, using optical sensors.

The controller can be used for strip-edge or strip-center guidance or stack height control.

It consists of a power amplifier for proportional valves, and an integrated module for strip guidance control.

**Operation**

Non-contact optical sensors measure the position of the strip edge. The output from a sensor is an electrical signal, which is fed to the strip guidance controller (signal ranges 0 to 20mA, 4 to 20mA, 0 to +10V, or 0 to +24V). When activated, the strip guidance controller maintains the strip edge exactly in the center of the measuring range.

If the position of the strip edge deviates from the center of the measuring range, the controller causes the actuator to move the strip edge back into position.

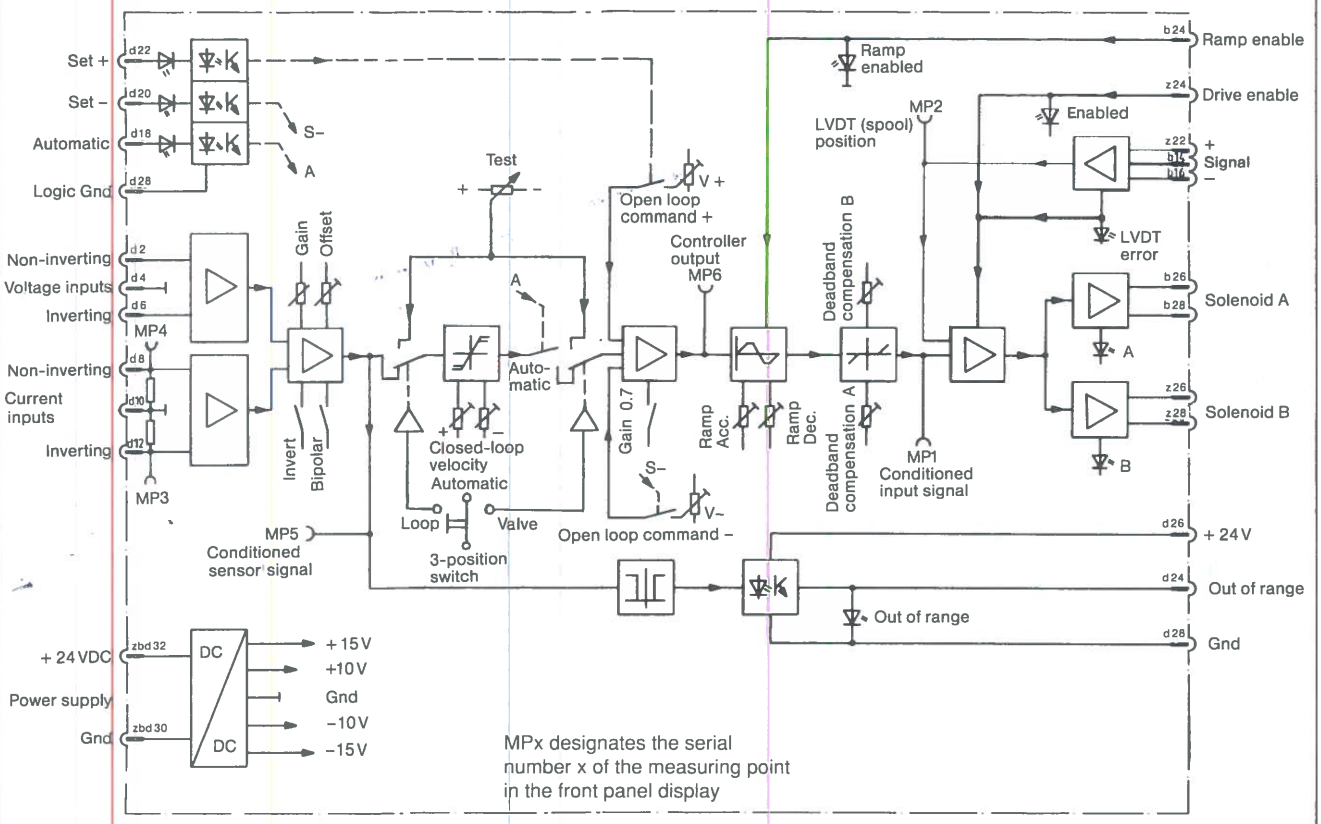
When closed-loop control is activated by the digital input signal "Automatic", the strip edge is moved from its current position into the measuring range of the sensor. The maximum actuator velocity (forwards and reverse) can be set on the front panel. Whenever the strip edge leaves the measuring range of the sensor, the controller generates a digital output signal which can be processed by the machine controller.

If closed-loop control is not activated, the controller can be operated open-loop. In this case the actuator travels at the velocity set by potentiometer "V+" when digital input "set +" is activated. "V –" and digital input "set –" are used for movements in the reverse direction.

A built-in test function together with front panel monitor points, considerably simplify run-off and fault diagnosis.

## 2. Circuit and connections

EEA-PAM-533/535-E example ▲

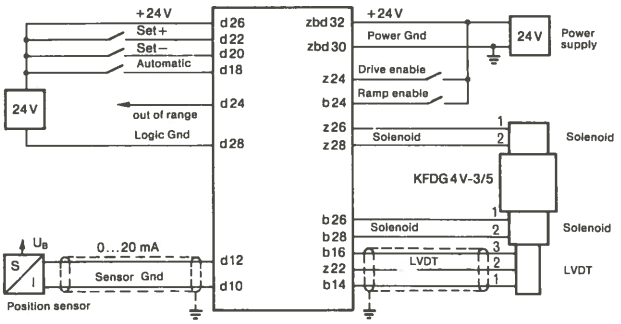



▲ See footnote at bottom of "Application examples" on next page

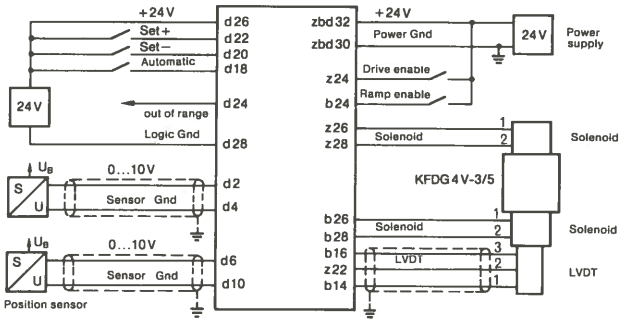
## Application examples

EEA-PAM-533/535-E amplifiers with KFDG4V-3/5 valves ▲

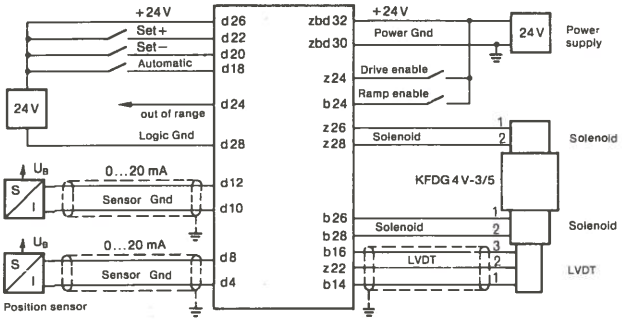
**Strip guidance control, stack height control, position sensor with current output**



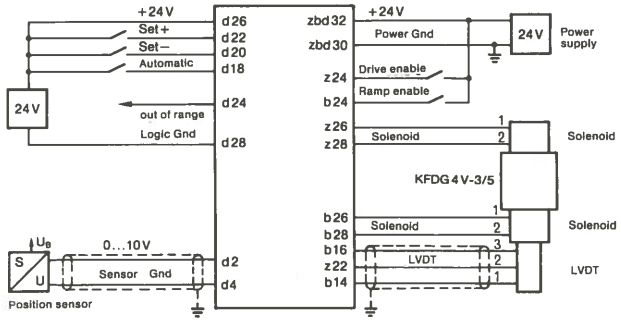

**Strip-center guidance control, position sensor with voltage output**




**Strip-center guidance control, position sensor with current output**




**Strip guidance control, stack height control, position sensor with voltage output**




▲ Other amplifier/valve combinations differ in respect to the LVDT and solenoid connections; see "Contents" pages for the relevant base amplifier EEA-PAM-5**-A-3*

## 3. Model codes

| Amplifier | For valves |
|---|---|
| EEA-PAM-523-E-3* | KDG4V-3----H7 |
| EEA-PAM-525-E-3* | KDG4V-5----H* |
| EEA-PAM-533-E-3* | KFDG4V-3 |
| EEA-PAM-535-E-3* | KFDG4V-5 |
| EEA-PAM-553-E-3* | KSDG4V-3 |
| EEA-PAM-561-E-3* | KFDG5V-5/7 |
| EEA-PAM-568-E-3* | KFDG5V-8 |
| EEA-PAM-581-E-3* | KHDG5V-5/7/8 |

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## 4. Operating data

| | | |
|---|---|---|
| Power supply | zbd32 | 24V DC nominal x 40W<br>Maximum voltage range:<br>20-40V (including ripple).<br>Maximum ripple: ±10% pk.-to-pk.<br>Amplifier shuts down below<br>18V DC.<br>Reverse-polarity protected. |
| Differential inputs for sensor: | | |
| Voltage input non-inverting | d2 | +24V max., $R_i$ = 100 kΩ |
| Voltage input, inverting | d6 | –24V max., $R_i$ = 100 kΩ |
| Current input, non-inverting | d12 | 20 mA max., $R_i$ = 100 Ω |
| Current input, inverting | d8 | 20 mA max., $R_i$ = 100 Ω |

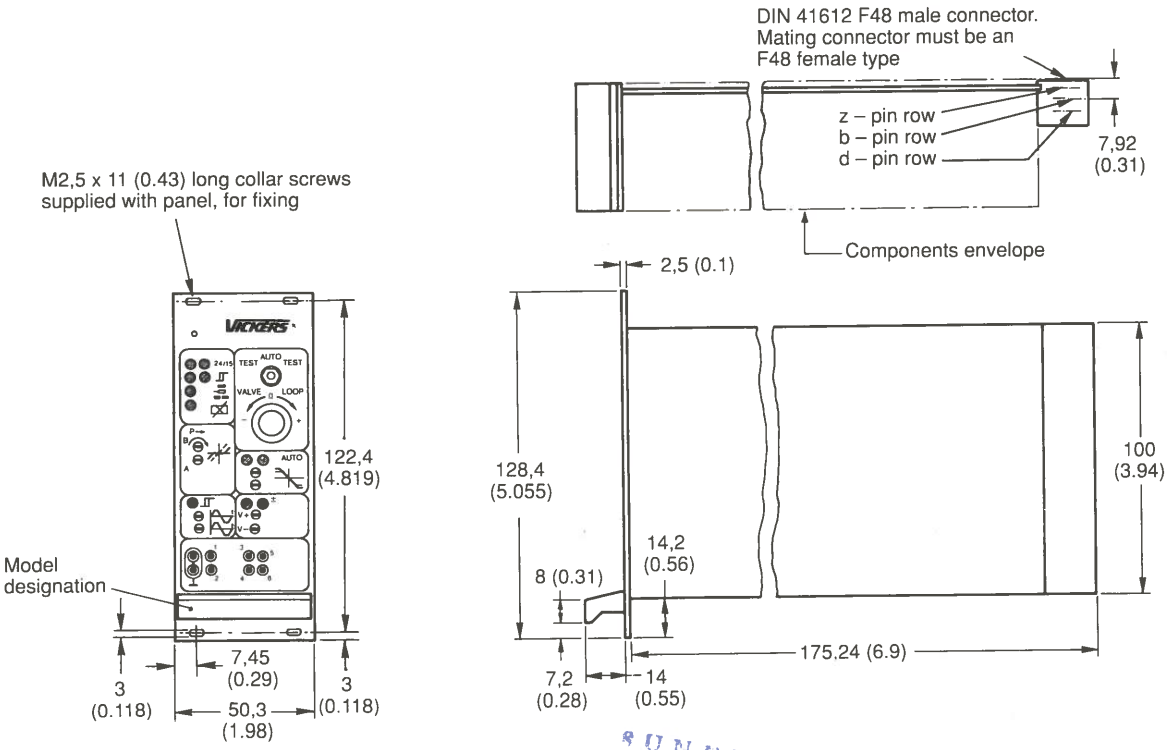
*Continued on next page*

| | | |
|---|---|---|
| Digital inputs (opto-isolated): | | |
| Set + | d22 | 24V DC nom., 20 to 40V DC max., $R_i$ = 2,7 kΩ |
| Set – | d20 | 24V DC nom., 20 to 40V DC max., $R_i$ = 2,7 kΩ |
| Automatic | d18 | 24V DC nom., 20 to 40V DC max., $R_i$ = 2,7 kΩ |
| Drive enable | z24 | Enable = 9,8 to 40V<br>Disable = 0 to 4,8V or open, $R_i$ = 47 kΩ |
| Ramp enable | b24 | Enable = 9,8 to 40V<br>Disable = 0 to 4,8V or open, $R_i$ = 47 kΩ |
| Digital output (opto-isolated) out of range | d24 | 24V DC nom. Short-circuit proof<br>$I_{max}$ = 100 mA |
| Potentiometers: | | |
| Deadband compensation | | Separate controls for each direction from spool-centered position.<br>0 to 50% of max. current |
| Ramp line adjustment | | Separate controls for acceleration and deceleration.<br>50 ms to 5 sec |
| Closed-loop velocities | | Separate controls for forward and reverse.<br>5 to 100% |
| Open-loop command | | Separate controls for forward and reverse.<br>0 to 100% |
| Monitor points (Numbers correspond to the numbering on the front panel and in the circuit diagram.) | | MP1: Conditioned input signal, ±10V<br>MP2: LVDT (spool) position, ±10V<br>MP3: Output signal of sensor with current output, non-inverting 0 to 2V = 0 to 20 mA<br>MP4: Output signal of sensor with current output, inverting, 0 to 2V = 0 to 20 mA<br>MP5: Conditioned sensor signal, ±10V<br>MP6: Controller output, ±10V<br>All monitor points are short-circuit proof. In all cases: R (out) = 10 kΩ |
| Test facilities | | 3-position switch for:<br>– Valve test mode<br>– Controller test mode<br>– Automatic operation mode |
| Operating temperature | | 0 to 50°C (32 to 122°F) |
| Storage temperature | | –25 to +85°C (–13 to 185°F) |
| Installation dimensions and panel display | | See next page |
| Coding pin hole location | | As for relevant base amplifier EEA-PAM-5**-A |
| Mass | | 0,4 kg (0.88 lb) |
| Installation and commissioning (start-up) | | See "Contents" pages |
| Supporting products:<br>Power supply unit options<br>Electronic accessories<br>Portable test equipment | | See "Contents" pages |

## 5. Installation dimensions in mm (inches)

3rd angle projection

**Plug-in unit of 3U height, to IEC 297**

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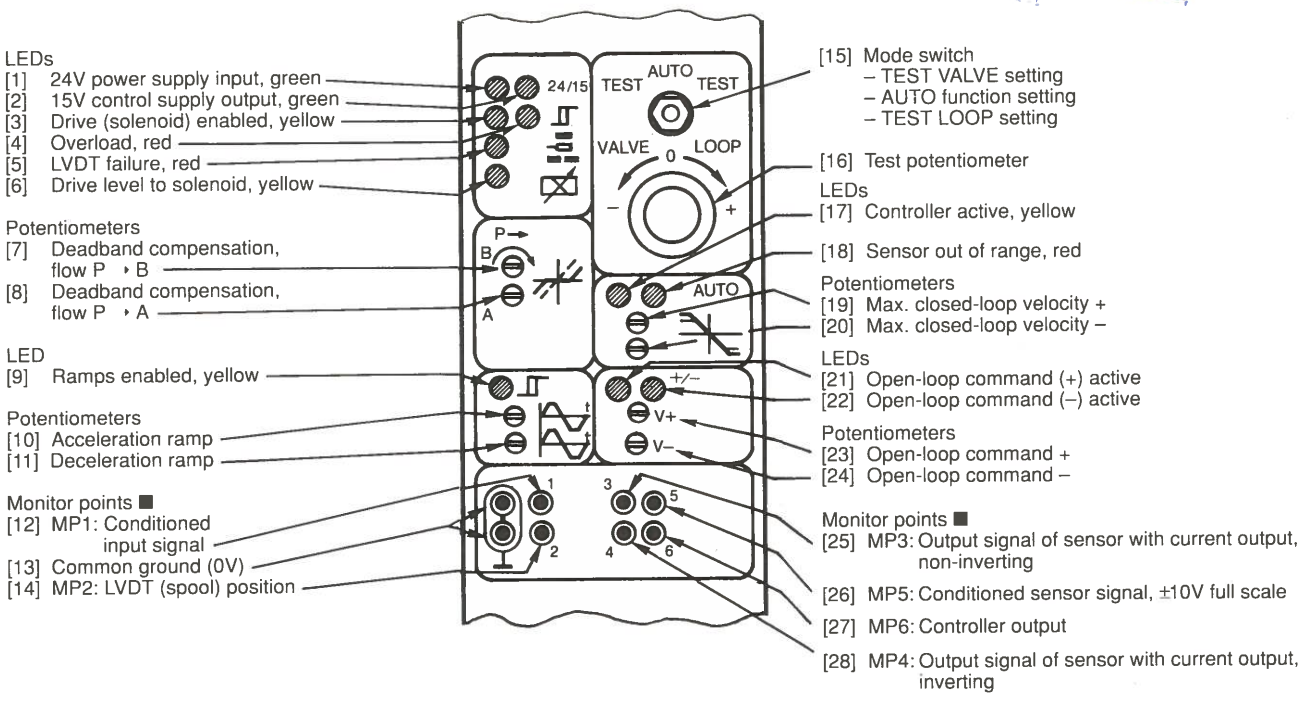
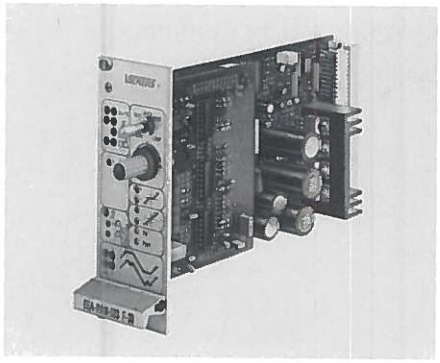
### Panel display




■ Ø2 (0.0787 dia) sockets

# Power amplifiers with CNC adaptation modules

EEA-PAM-5**-F-30 series



## 1. General description

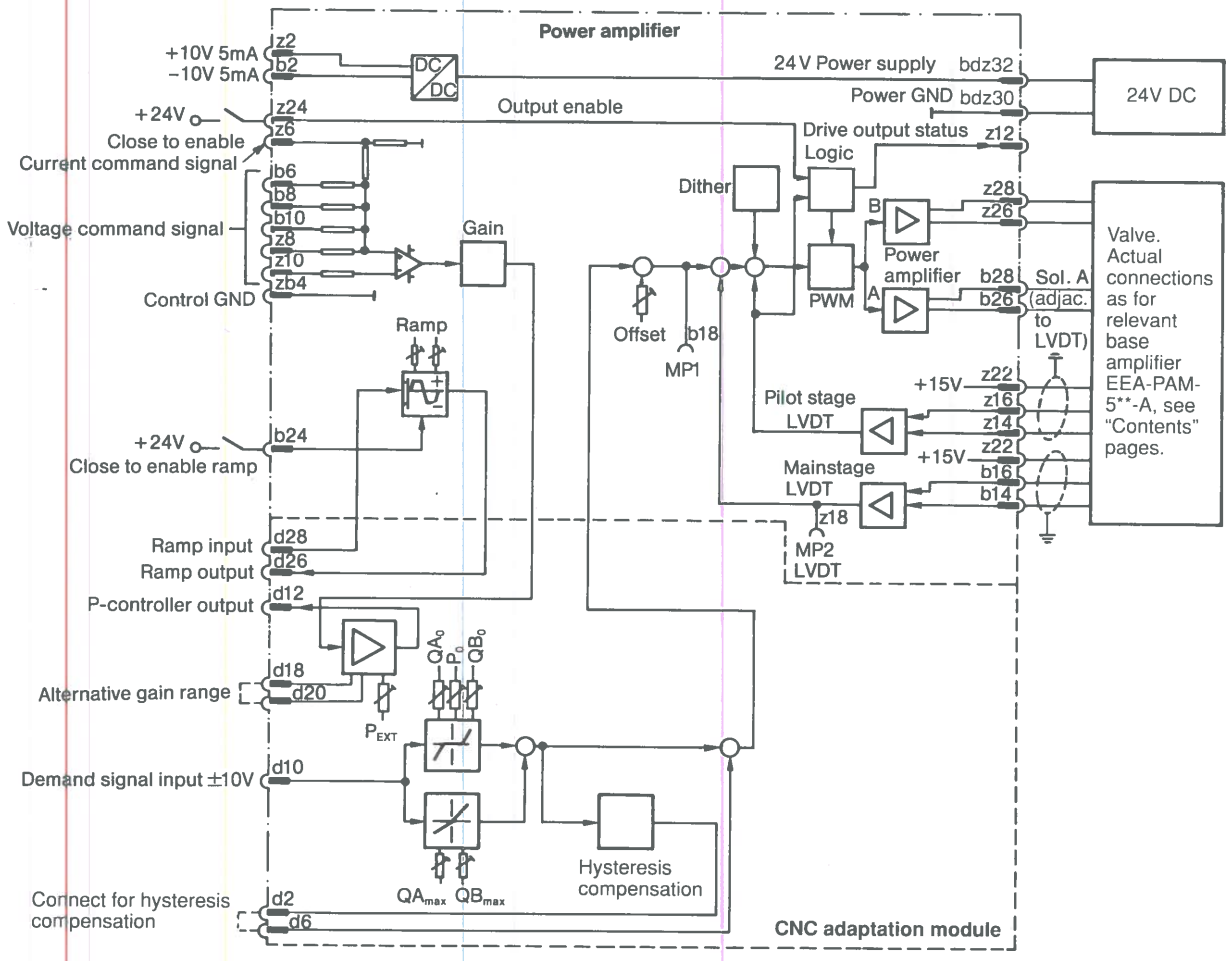
The EEA-PAM-5**-F-30 Eurocards are power amplifiers with integrated CNC adaptation modules. Each card replaces two conventional electronic cards.

These power amplifiers are used for high accuracy positioning systems with inexpensive standard proportional valves and CNC axis or PLC position controls.

**Benefits**

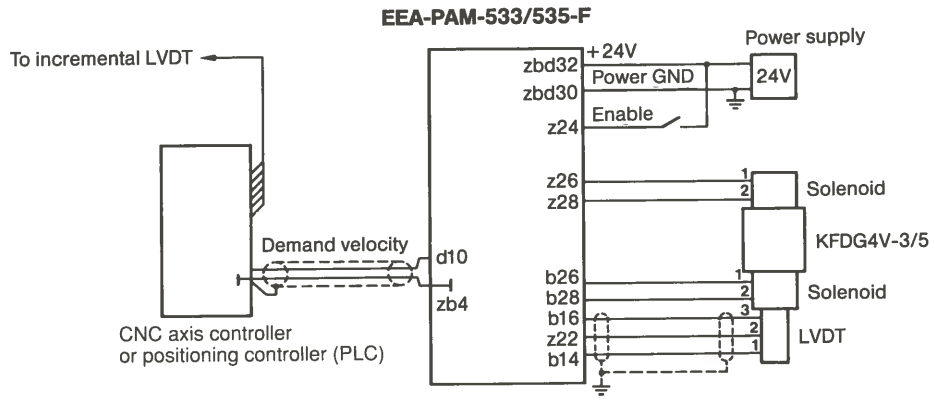
- This particular configuration reduces the amount of external wiring, saves space in the rack enclosure and requires only one 24V power supply.
- Smooth transition between the overlap region and working region.
- Hysteresis compensation for valves without spool position feedback.
- Low cost, high accuracy positioning systems with overlapped proportional valves. Non-linearities and inconsistencies (friction) in the overlap region are compensated by the electronic linearization.
- Simple set-up procedure.
- A built-in test function significantly simplifies commissioning (start-up) and fault-diagnosis.

## 2. Circuit and connections



## Application example

Positioning module with CNC axis controller




## 3. Model codes

| Amplifier | For valves |
|---|---|
| EEA-PAM-523-F-3* | KDG4V-3----H7 |
| EEA-PAM-525-F-3* | KDG4V-5----H* |
| EEA-PAM-533-F-3* | KFDG4V-3 |
| EEA-PAM-535-F-3* | KFDG4V-5 |
| EEA-PAM-561-F-3* | KFDG5V-5/7 |
| EEA-PAM-568-F-3* | KFDG5V-8 |
| EEA-PAM-581-F-3* | KHDG5V-5/7/8 |

## 4. Operating data

| | | |
|---|---|---|
| Power (input) supply | bdz32 | 24V DC nominal x 40W.<br>Maximum voltage range:<br>20-40V (including ripple).<br>Maximum ripple: ±10% pk.-to-pk.<br>Amplifier shuts down below<br>18V DC.<br>Reverse-polarity protected. |
| Control (output) supplies | z22, b22 | Not available for external use. |
| Reference voltages | z2<br>b2 | +10V, 5 mA<br>–10V, 5 mA |
| Analog inputs:<br>Command inputs<br>Direct voltage inputs<br>Inverting voltage input<br>Voltage range<br>Input impedance (voltage)<br>Current input<br>Current range<br>Input impedance (current)<br>Input ramp<br>Voltage range<br>Input impedance<br>Velocity demand signal<br>Voltage range<br>Input impedance | <br><br>b6, b8, b10, z8<br>z10<br><br><br>z6<br><br><br>d28<br><br><br>d10<br><br> | <br><br><br><br>±10V<br>47 kΩ<br><br>±20 mA<br>100Ω<br><br>±10V<br>10 kΩ<br><br>±10V<br>15 kΩ |
| Digital inputs:<br>Drive enable (power available to solenoid)<br>Ramps enable<br>Enabled<br>Disabled<br>Load current | <br>z24<br>b24<br><br><br> | <br><br><br>17V to 40V<br>0V to 3,5V<br>≤10 mA |

*Continued on next page*

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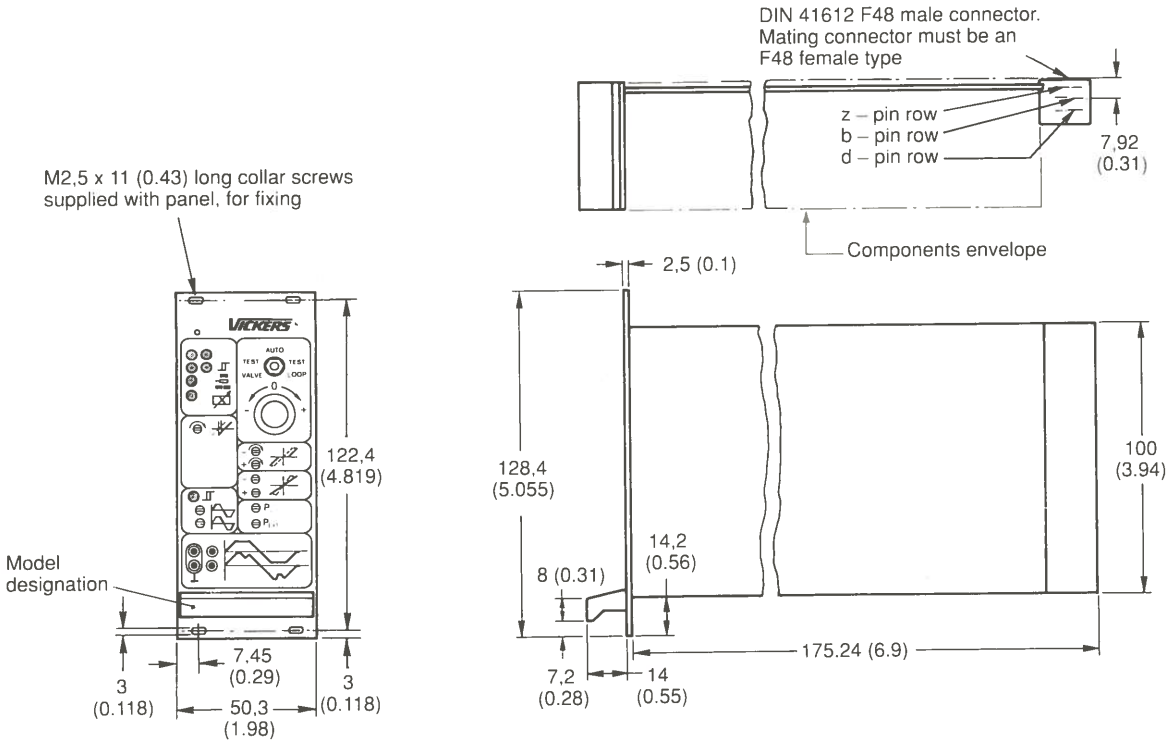
| | |
|---|---|
| Analog outputs:<br>P-controller output d12<br>Voltage range<br>Load impedance<br>Output ramp generator d26<br>Voltage range<br>Load impedance | <br><br>±10V<br>≥10 kΩ; short circuit proof.<br><br>±10V<br>≥10 kΩ; short circuit proof. |
| Potentiometers:<br>Deadband compensation, separate control for each solenoid<br>Gain, separate control for each solenoid<br>$P_0$-Deadband gain<br>$P_{ext}$-Gain controller:<br>Without link<br>Link d18 to d20 | <br><br>0 to 50%<br>40 to 90%<br>15 to 43 times<br><br>0,1 to 5 times<br>2 to 100 times |
| Integrated P-controller | The input circuit of the power amplifier card is used as a differential amplifier between the demand signal and feedback signal. The ramp signal generator can be used as profile generator.<br><br>**Caution:** When using "TEST LOOP" the command signal has to be connected to d8, and d14 has to be connected to the command signal input of the input stage. |
| Hysteresis compensation:<br>Link d2 to d6 | <br>For KDG4V-* valves only |
| Monitor points:<br>Conditioned command signal power amplifier MP1<br>LVDT (spool) position MP2<br>Voltage range<br>Monitor point impedance | <br><br><br>±10V<br>10 kΩ |
| Ambient conditions:<br>Storage temperature range<br>Operating temperature range | <br>–25 to 85°C (–13 to 185°F)<br>0 to 50°C (32 to 122°F) |
| Installation dimensions and panel display | See next page |
| Coding pin hole location | As for relevant base amplifier EEA-PAM-5**-A-3* |
| Mass | 0,4 kg (0.88 lb) |
| Installation and commissioning (start-up) | See "Contents" pages |
| Integrated test modes | See two pages on |
| Supporting products:<br>Power supply unit options<br>Electronic accessories<br>Portable test equipment | See "Contents" pages |

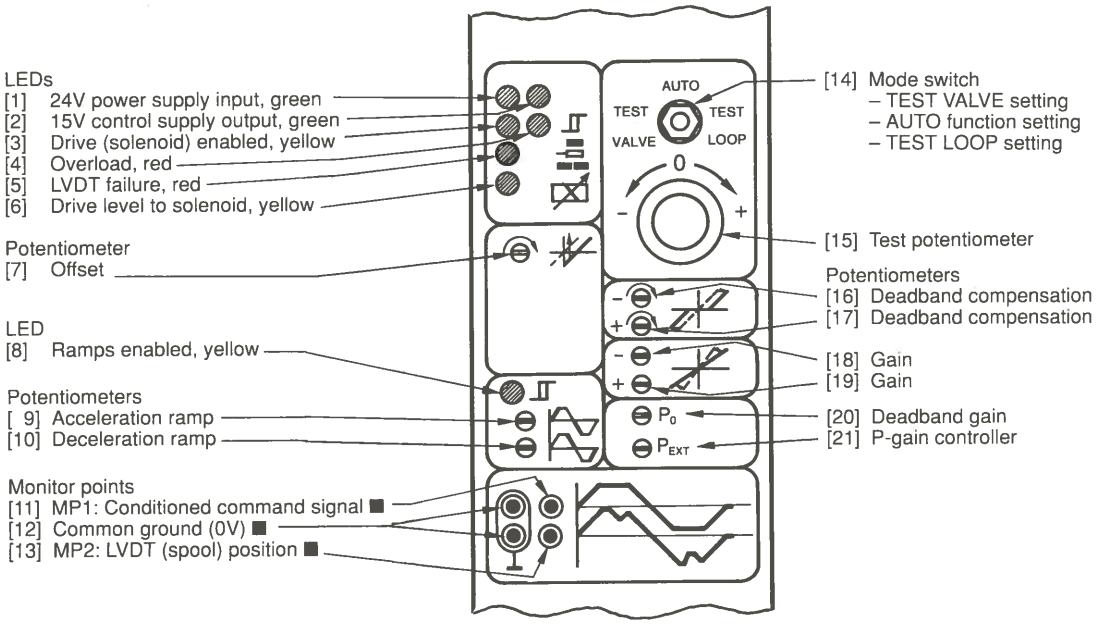
## 5. Installation dimensions in mm (inches)

3rd angle projection

**Plug-in unit of 3U height, to IEC 297**




### Panel display




■ Ø2 (0.0787 dia.) sockets

## 6. Operation of the integrated test modes

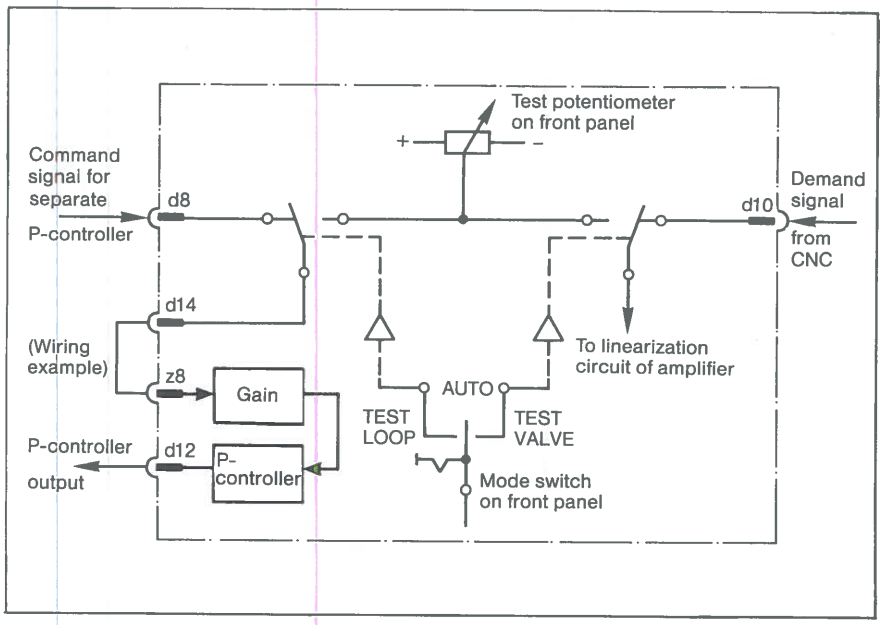
The basic operation of the hydraulic actuator can be tested by using the 3-position mode switch mounted on the front panel. To select different modes the toggle switch must be lifted slightly before moving to a new position.

**Caution:**
Before setting the mode switch to either "Test valve" or "Test loop" make sure the test potentiometer is set to "0". Otherwise sudden movements of the actuator may occur.

The mode switch has three positions:
"AUTO"
The controller operates in closed-loop mode, using the external command signal. The test potentiometer is disconnected.

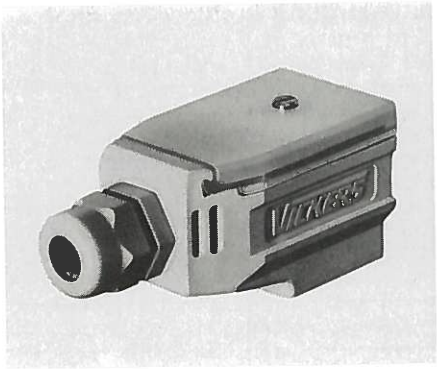
"TEST VALVE"
An open-loop command signal for the valve comes directly from the potentiometer. The external input signal is disconnected. The hydraulic part of the system may be tested in this configuration.

"TEST LOOP"
The test potentiometer can be used to drive the separate P-controller, if "TEST LOOP" is selected. The external input signal is disconnected. See wiring example. "TEST LOOP" is usable only if the separate P-controller is used.



# "Soft switch" power plugs

EHH-AMP-702-C, 10 series
EHH-AMP-702-F, 10 series



## 1. General description

These plugs, conforming to ISO 4400/ DIN 43650 interface, offer adjustable, ramped on/off switching times through the use of an integral amplifier.

Two switching times ranges are available:
– model type C, 10 – 600 ms
– model type F, 0,5 – 5s

The soft switch plug is rated for 24V DC nominal and controlled by a 24V logic signal. Applying an "on" signal causes the output current to ramp up to, and to stay at, an adjustable maximum while the "on" signal is maintained. At "switch-off" the output current is ramped down to zero, and will remain at zero until the next "on" signal.

Ramp times (i.e. switching times) can be adjusted by in-built potentiometers.

An adjustment also allows for compensation of any deadband in the load.

## 2. Features and benefits

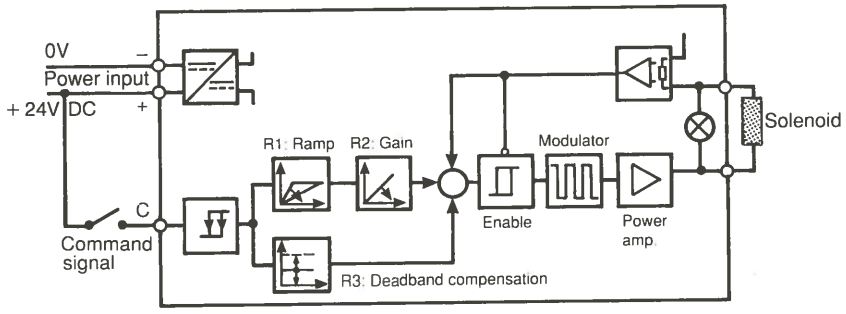
- Integral amplifier provides control from on/off logic command signal
- Adjustable ramp time
- Deadband compensation
- Adjustable output level
- Improved switching time repeatability
- Reduction of EMI radiation
- Fully short-circuit and reverse-polarity protected

## 3. Application

Focus applications for this plug are in the control of hydraulic solenoid operated directional and pressure control valves where control of valve response time can significantly reduce shocks in the hydraulic system.

Best results in reducing hydraulic shocks will only be obtained by using valves with the right "low shock", or "proportional" features.

Electrical block function diagram




## 4. Model code

**EHH-AMP-702- * - 1***
[1] [2]

[1] **Adjustment range**
C = Soft switch power plug: 10 ms to 600 ms
F = Soft switch power plug: 0,5s to 5s

[2] **Design number, 10 series**
Subject to change: installation dimensions unaltered for design numbers 10 to 19 inclusive.

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## 5. Operating data

### 5.1 Electrical

| | |
|---|---|
| Power supply | 20 – 28V DC: incl. ±10%<br>max. ripple peak-to-peak |
| Protection | IEC 529; IP65 (when correctly installed with interface seal in place)<br>Fully short-circuit and reverse-polarity protected |
| Isolation to VDE 0110 | Group "B" |
| Output current:<br>rated<br>cut-off<br>short-circuit | <br>1,6A<br>3A<br>0,1A rms typical |
| Max. load impedance | 12 ohms |
| Output voltage | Typically 0,5V below input voltage |
| Command signal<br>for "on"<br>for "off" | <br>≥13V ≤32V<br>≤5V |
| Input impedance (signal) | 2700 ohms |
| PWM frequency | 400 Hz typical |
| Ramp time:<br>model type **C**<br>model type **F** | <br>10 ms to 600 ms<br>0,5s to 5s |
| Output range | 0,5A to 1,8A |
| Deadband compensation | 0 to 1A |

### 5.2 Mechanical

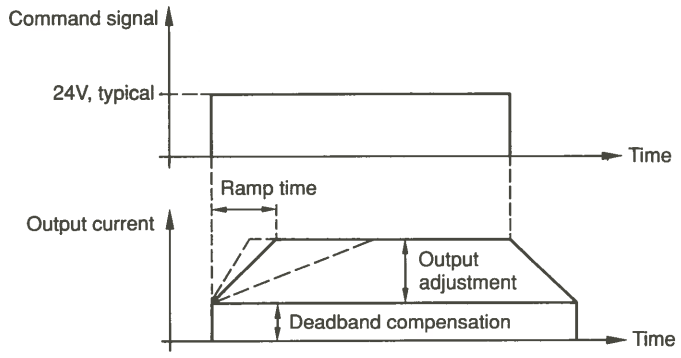
| | |
|---|---|
| Housing | PA6 glass reinforced plastic (conforming to UL-94HB)<br>Color: gray |
| Mounting interface | ISO 4400 (DIN 43650) |
| Cable clamp | Pg9 screw type |
| Cable diameter | Ø5-10 mm (0.197-0.394" dia) |
| Wire section | 0,5-1,0 $mm^2$ (0.001-0.002 $in^2$)<br>(20AWG-18AWG) |
| Temperature, ambient range | –20 to +70°C (–4 to +158°F) |
| Mass | 0,07 kg (0.154 lb) |

### 5.3 Functions

● Switch-on/off: after switching on with a 13V signal the amplifier will remain in the "on" condition with a command signal above 6V. The command signal must be reduced to below 5V to achieve switch-off of the amplifier.

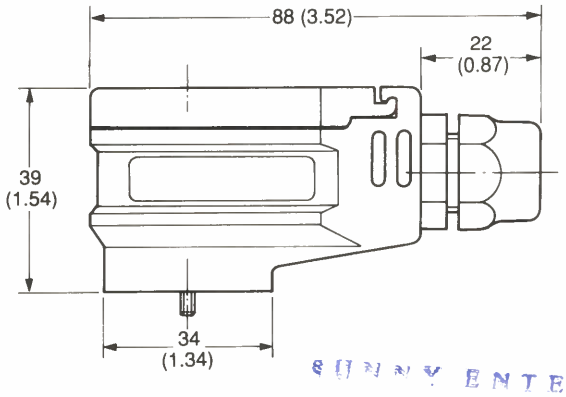
● Adjustments:
– Ramp
Ramp time is adjustable by potentiometer R1
– Output
Maximum output current is adjustable by potentiometer R2
– Deadband compensation
Deadband compensation is adjustable by potentiometer R3

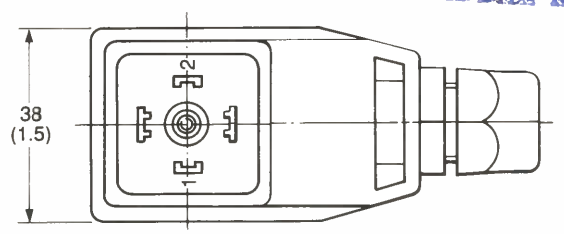
Input/output characteristic




## 6. Installation dimensions in mm (inches)

3rd angle projection

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## 7. Installation data

**Commissioning (start-up) procedure**

1. Correctly wire the plug and, before mounting it on the valve solenoid, apply 24V DC (20 to 28V limits) to the "power input" terminal.

2. Check for correct plug function by illumination/non-illumination of the LED:
a. Apply less than 2 to 3 volts to the input terminal: the LED should not be illuminated.
b. Increase voltage: the LED should illuminate when the voltage reaches 13V. *Do not exceed 32V command signal.*
c. Decrease voltage: the LED should go off when the voltage is less than 5V.

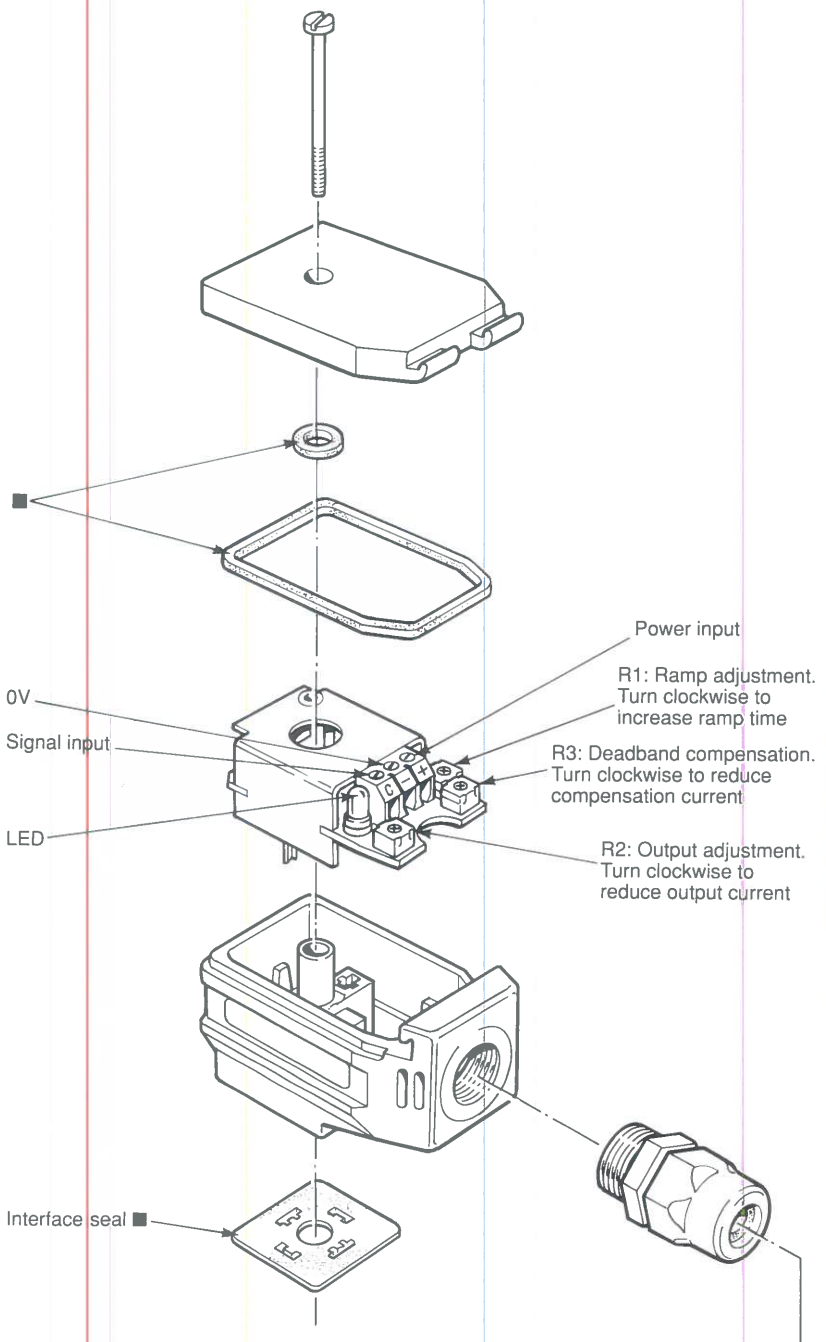
If there is a malfunction a new plug must be fitted.

3. Switch off power supply and command/input signal and then install plug on solenoid. Ensure that all seals are fitted correctly and clamped as the retaining bolt is tightened: *this is essential in providing IP65 protection.*

4. *Ensure that the hydraulic system will not cause any unsafe movement of actuators, then:*
– Switch on power supply again.
– Repeat LED/function check as in 2.
An LED malfunction now indicates a short circuit at the load.

5. Successful completion of these checks means that the plug and load are ready for use.

Assembly showing wiring connection points, LED and adjustment potentiometers

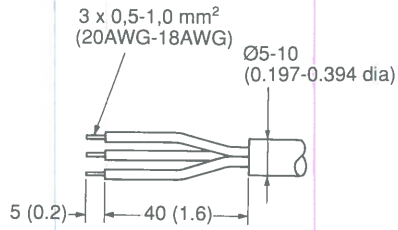

Power input
R1: Ramp adjustment. Turn clockwise to increase ramp time
0V
Signal input
R3: Deadband compensation. Turn clockwise to reduce compensation current
LED
R2: Output adjustment. Turn clockwise to reduce output current
Interface seal ■

Warnings

- Ensure cable clamp nut is adequately tightened to secure the cable
- Do not install, or remove, the plug when power is on
- Do not connect, or disconnect, the wiring while power is on

■ All seals must be fitted correctly at plug installation to provide protection to IP65 (IEC 529)

Wiring preparation




## 8. Spare parts

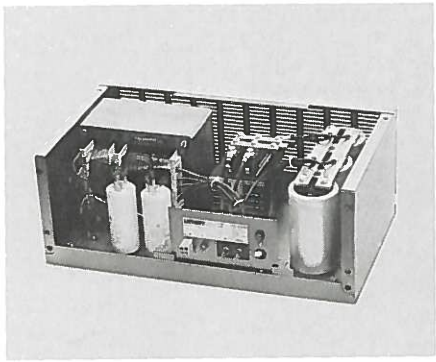
The only spare part available is the interface seal, part number 732100.

## 9. Ordering procedure

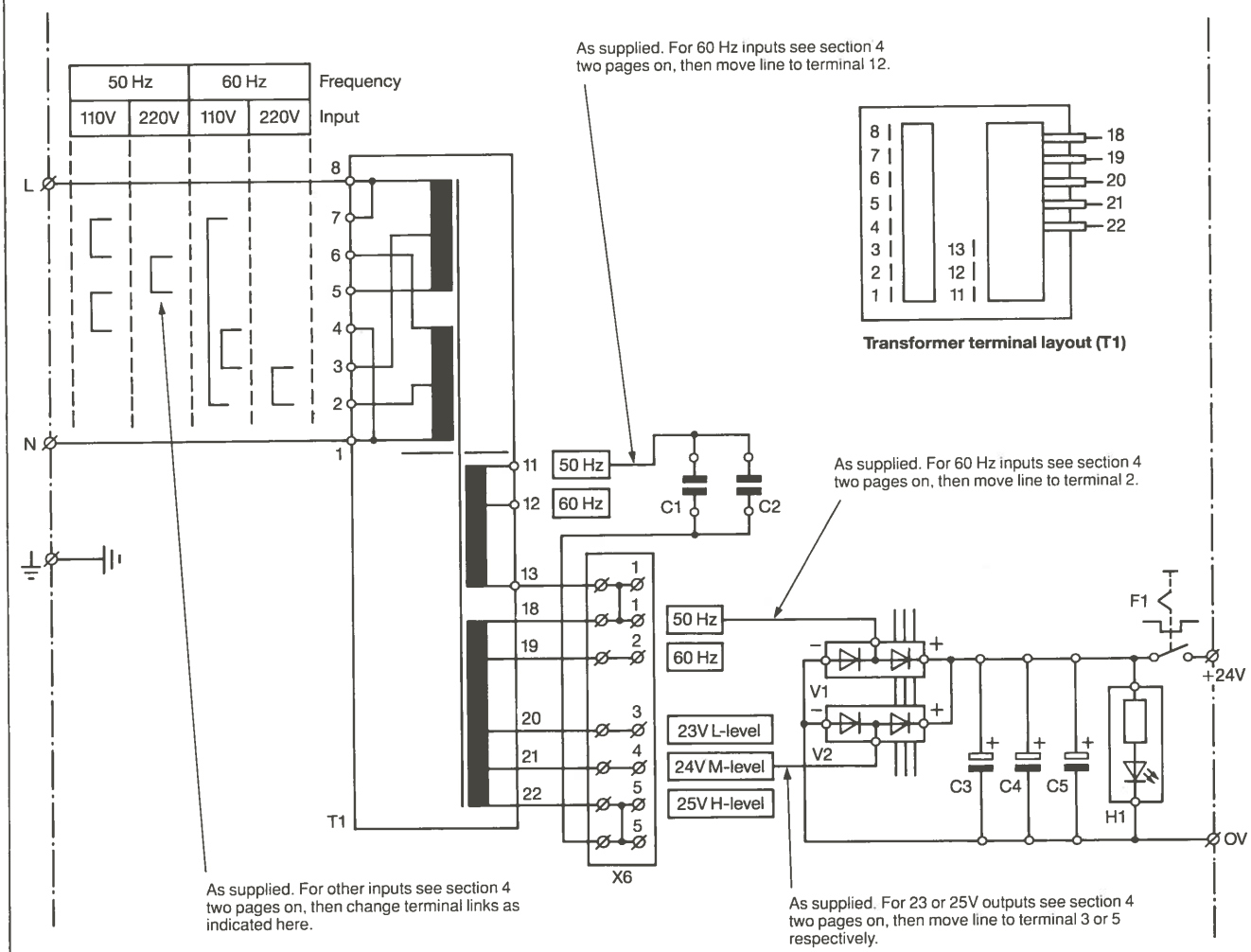
Order plug by full model code, and spare interface seal by part number 732100.

# Power supply units
# 24V DC x 20A max. output

EHA-PSU-703-A-10 series



## 1. Circuit and connections




Transformer terminal layout (T1)

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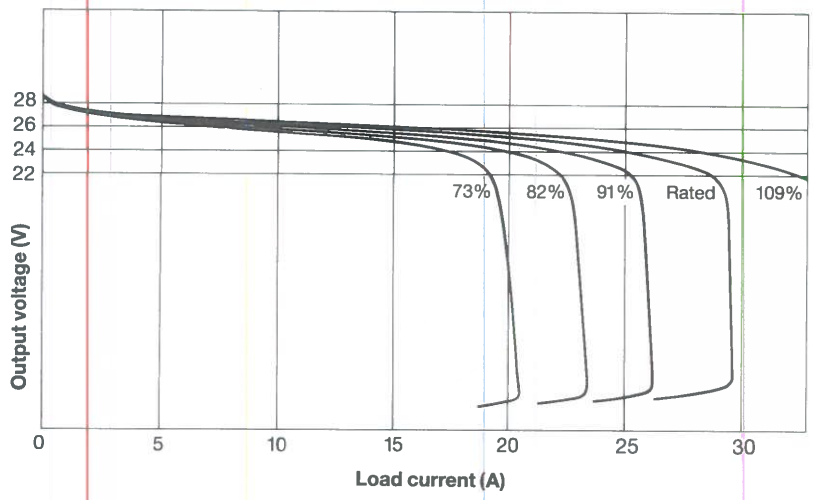
## 2. Operating data

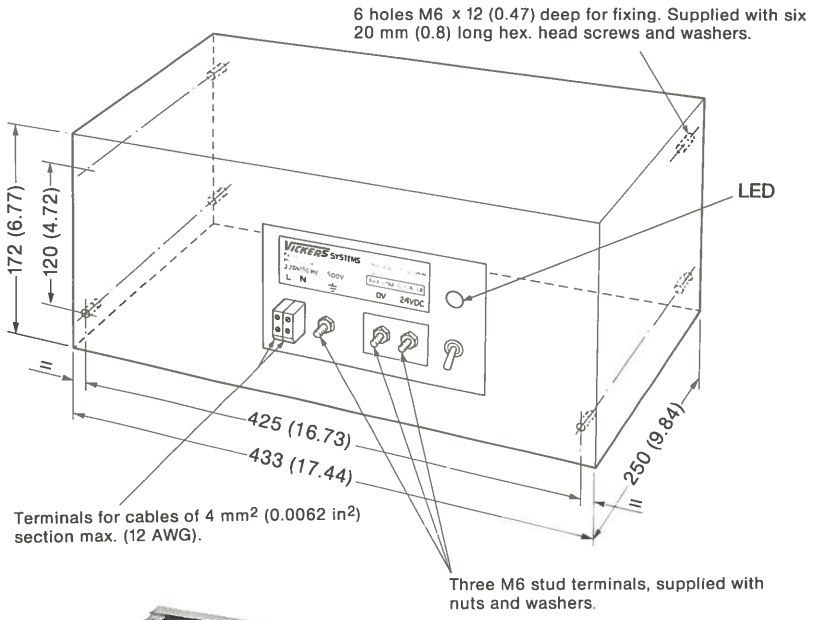
| | |
|---|---|
| Input voltage options:<br>Factory-setting<br>By on-site re-connection<br>or<br>or | <br>220V (±20%) AC 50Hz<br>110V (±20%) AC 50Hz<br>110V (±20%) AC 60Hz<br>220V (±20%) AC 60Hz |
| Output voltage:<br>Factory-setting<br>By on-site re-connection | <br>24V DC rated<br>23 or 25V DC |
| Output current | 20A max. |
| Output voltage/load current | See graph below |
| Output voltage variation (Input voltages 20 % of rated, and load variation from 0-100 %) | < ± 6% |
| Output ripple | 0,8V @ 20A |
| Overall efficiency | > 80% |
| Ambient temperature range | 0 to 50° C (32 to 122° F) |
| Durability | MTBF > 500,000 h |
| Installation dimensions | See next page |
| Mass | 25,4 kg (56 lb) |
| Installation and commissioning (start-up) | See section 4 on next page |

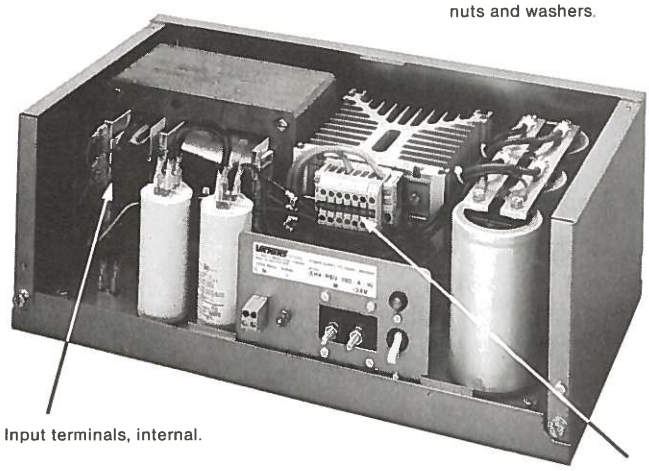
● **Output voltage/load current**

Performance at stated percentages of rated input voltage.



## 3. Installation dimensions in mm (inches)


6 holes M6 x 12 (0.47) deep for fixing. Supplied with six 20 mm (0.8) long hex. head screws and washers.
LED
172 (6.77)
120 (4.72)
425 (16.73)
433 (17.44)
250 (9.84)
Terminals for cables of 4 mm² (0.0062 in²) section max. (12 AWG).
Three M6 stud terminals, supplied with nuts and washers.




## 4. Installation and commissioning (start-up) guidelines

**4.1** New power supply units have been factory-set for rated conditions, i.e. 220V AC 50 Hz input and 24V DC output. If other voltage conditions are required, possibly also if an existing unit is to be transferred to another application, change the internal connections to match the required voltages:

a) **Important** - Check that no power is connected to the unit.
b) Remove combined front-and-top cover then re-locate connection leads to the appropriate terminals as shown two pages back and in adjacent photograph.
c) Replace combined cover.

**4.2** Install unit on the application, making use of the six fixing points (4 at rear and 2 at the front).
**4.3** Connect input lines to appropriate terminals L, N and ⏚.
**4.4** Connect output lines to appropriate terminals +24V and 0V.
**4.5** Switch on power supply. The integral LED illuminates.

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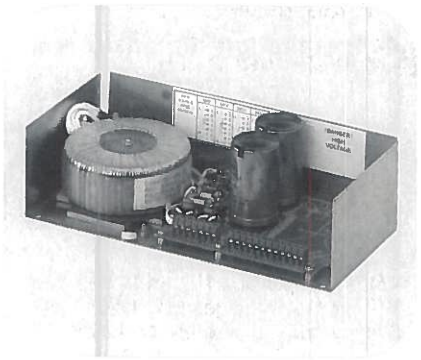
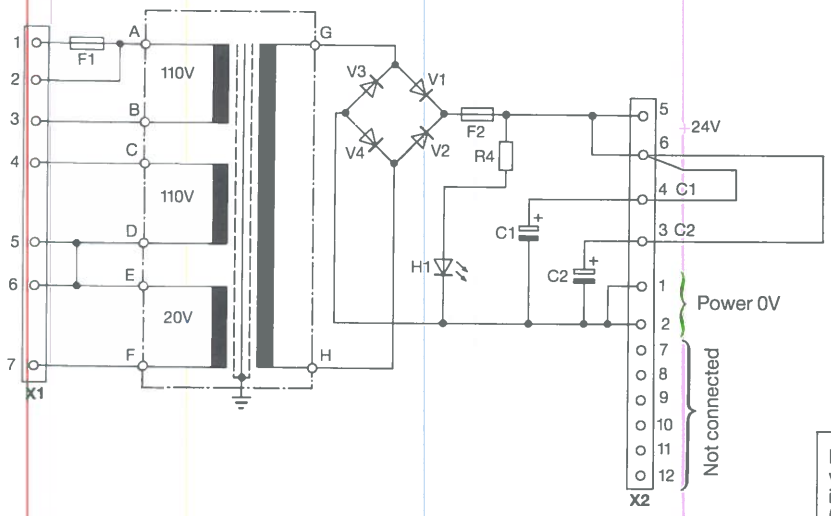
# Power supply units
# 24V DC x 3,5A max. output

EHA-PSU-704-A/B-10 series



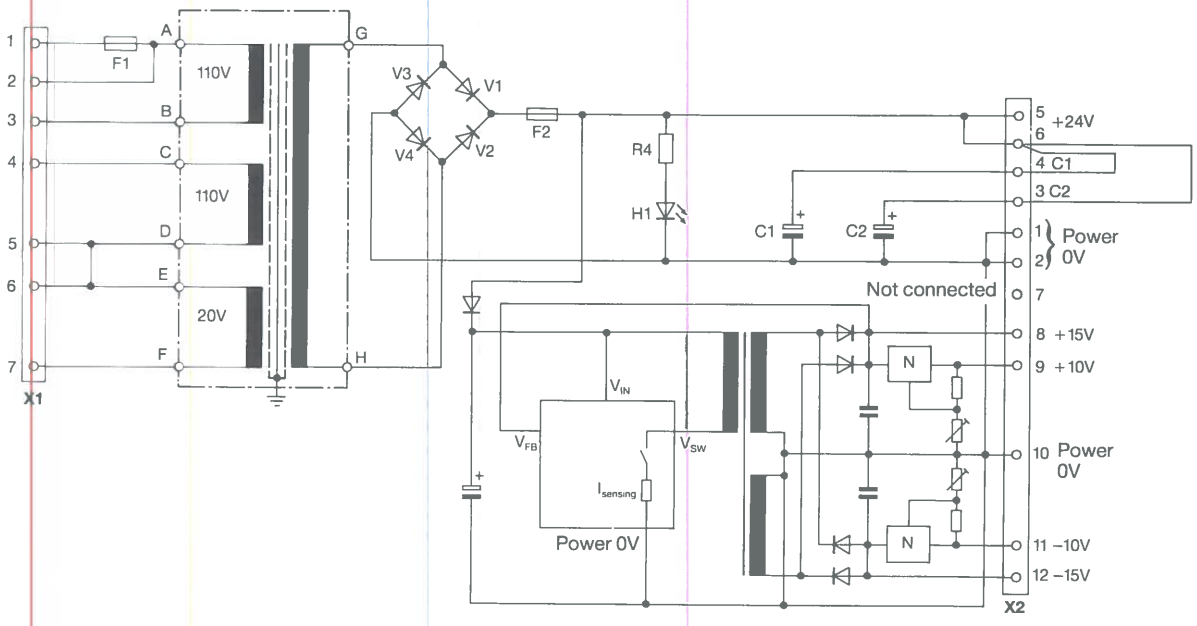
## 1. Circuit and connections

### EHA-PSU-704-A-10 models




| Primary voltage input 50/60 Hz | 110V | 130V | 220V | 240V |
|---|---|---|---|---|
| | L–1 | L–1 | L–1 | L–1 |
| | 2 | 2 | 2 | 2 |
| | 3 | 3 | 3 | 3 |
| | 4 | 4 | 4 | 4 |
| | 5 | 5 | 5 | 5 |
| | N–6 | 6 | N–6 | 6 |
| | 7 | N–7 | 7 | N–7 |

### EHA-PSU-704-B-10 models



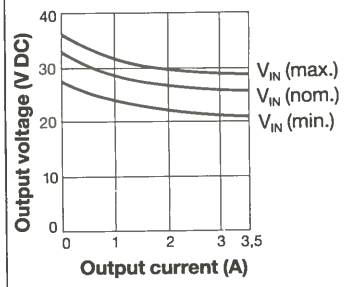
## 2. Model code

**EHA-PSU-704-*-1***
[1] [2]

[1] **Output(s)**
A = 24V DC 3,5A max.
B = 24V DC 3,2A max.
±15V DC 250 mA max.
±10V DC 50 mA max.
} Stabilized

[2] **Design number, 10 series**
Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.

## 3. Operating data

| | |
|---|---|
| Power (input) supply options | 110/130/220/240V AC<br>(0 to −15%) 50/60 Hz<br>Selected by on-site connections |
| Input fuse F1:<br>Factory-fitted for 220/240V AC inputs<br>User-fitted for 110/130V AC inputs<br><br>**Notes**<br>1. Ø5 x 20mm (.20" x .79") fuses normally used. Users can fit Ø6,3 x 32mm (.25" x 1.25") fuses if necessary but with a different fuse cap.<br><br>2. A 1,6A (T) fuse is supplied loose with each unit for the user to substitute for the 0,8A fuse if a 110/130V AC 50/60 Hz supply is to be used instead (see section 5.3 for details). | 0,8A (T) at 250V<br>1,6A (T) at 250V |
| Output voltage options | See [1] in "Model code" |
| Output rating | 24V DC x 3,5A max. |
| Output voltage/current (measured with 2 x 4700µF capacitors in circuit) |  |
| Output ripple, with following capacitors and 3,5A load▲: With 1 x 4700µF @ 50 Hz<br>With 2 x 4700µF @ 50 Hz<br>With 1 x 4700µF @ 60 Hz<br>With 2 x 4700µF @ 60 Hz | <br>1,5 Vpp<br>0,75 Vpp<br>1,24 Vpp<br>0,62 Vpp |
| Output fuse F2, factory-fitted | 6,3A(T) @ 250V |
| Auxiliary outputs, typical values, EHA-PSU-704-B models only<br><br><br><br><br><br>Temperature coefficient<br>Voltage regulation<br>Output protection | +10V ± 200 mV x 50 mA:<br>30 mVpp ripple<br>−10V ± 200 mV x 50 mA:<br>30 mVpp ripple<br>+15V ± 750 mV x 250 mA:<br>100 mVpp ripple<br>−15V ± 750 mV x 250 mA:<br>100 mVpp ripple<br>1 mV/°C<br><0,5%<br>Short-circuit protection with auto-resetting |
| Ambient temperature range | 0 to 50°C (32 to 122°F) |
| Installation dimensions | See next page |
| Mass | 2,4 kg (5.29 lb) approx. |
| Installation and commissioning (start-up) | See next page |

▲ See previous page re. connections from capacitors C1 and C2

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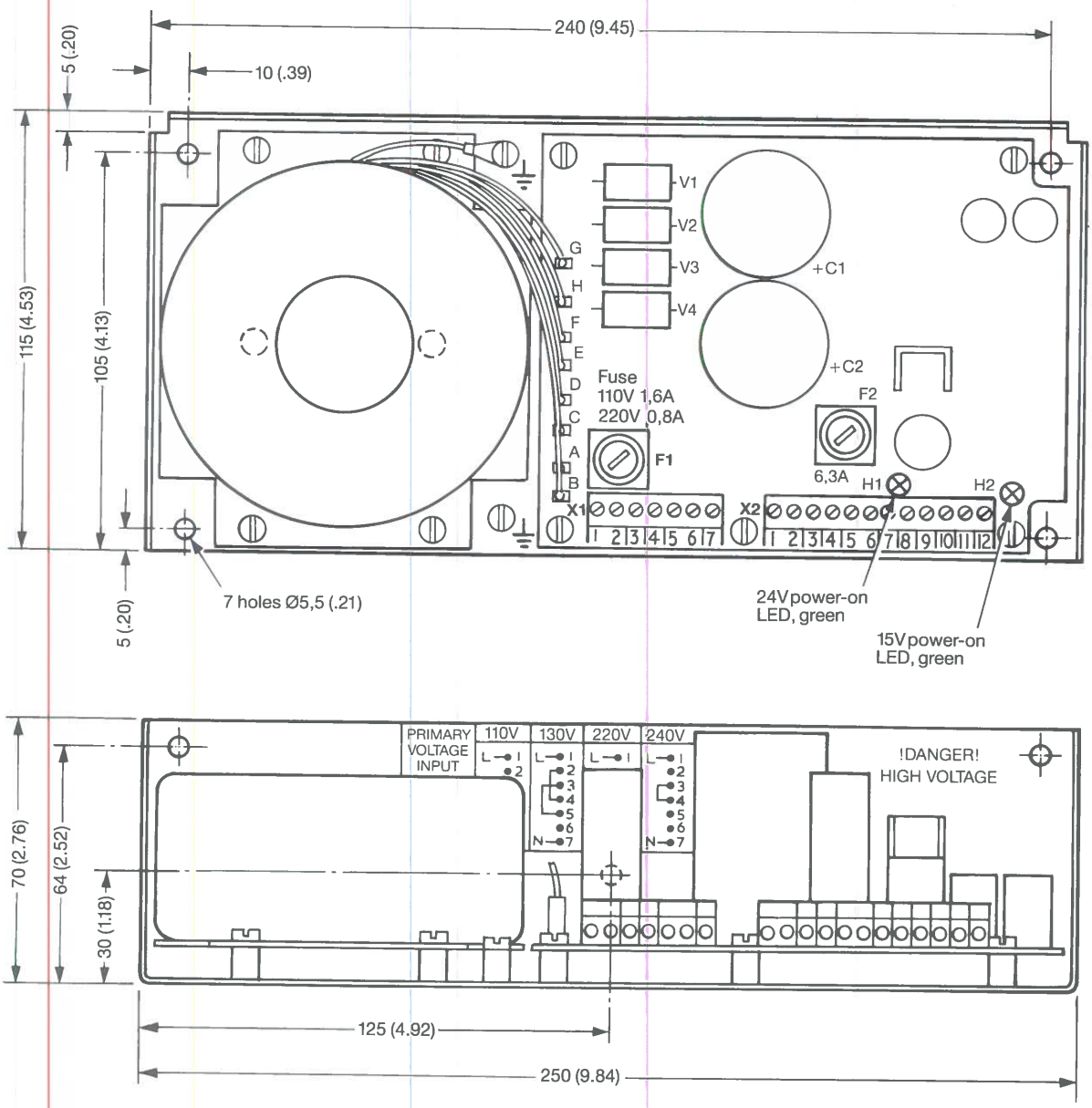
## 4. Installation dimensions in mm (inches)

**Dimensions of all models (EHA-PSU-704-B illustrated)**

3rd angle projection




## 5. Installation and commissioning (start-up) guidelines

**5.1** Fix the unit to a suitable base, using sufficient of the seven fixing holes (4 through the base and 3 through the back panel); see illustration above.

**5.2** Make the necessary connections to terminal strip X2 to provide the required outputs; see appropriate circuit diagram two pages back.

**5.3** Units are shipped from the factory with an 0,8A (T) fuse fitted at F1 (see circuit diagram two pages back) to suit 220/240V AC 50/60 Hz mains supplies. If a unit is to be connected to a 110/130V AC 50/60 Hz mains supply, first change the 0,8A fuse F1 to a 1,6A (T), supplied loose with each power supply unit.

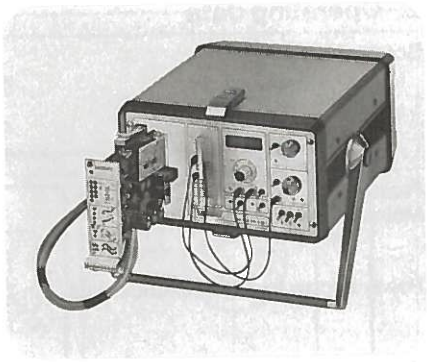
**5.4** Switch off the intended mains supply then make appropriate connections to terminal strip X1 to suit the mains supply.

**5.5** The EHA-PSU-704 power supply unit will now be ready for use when the mains supply is switched on externally.

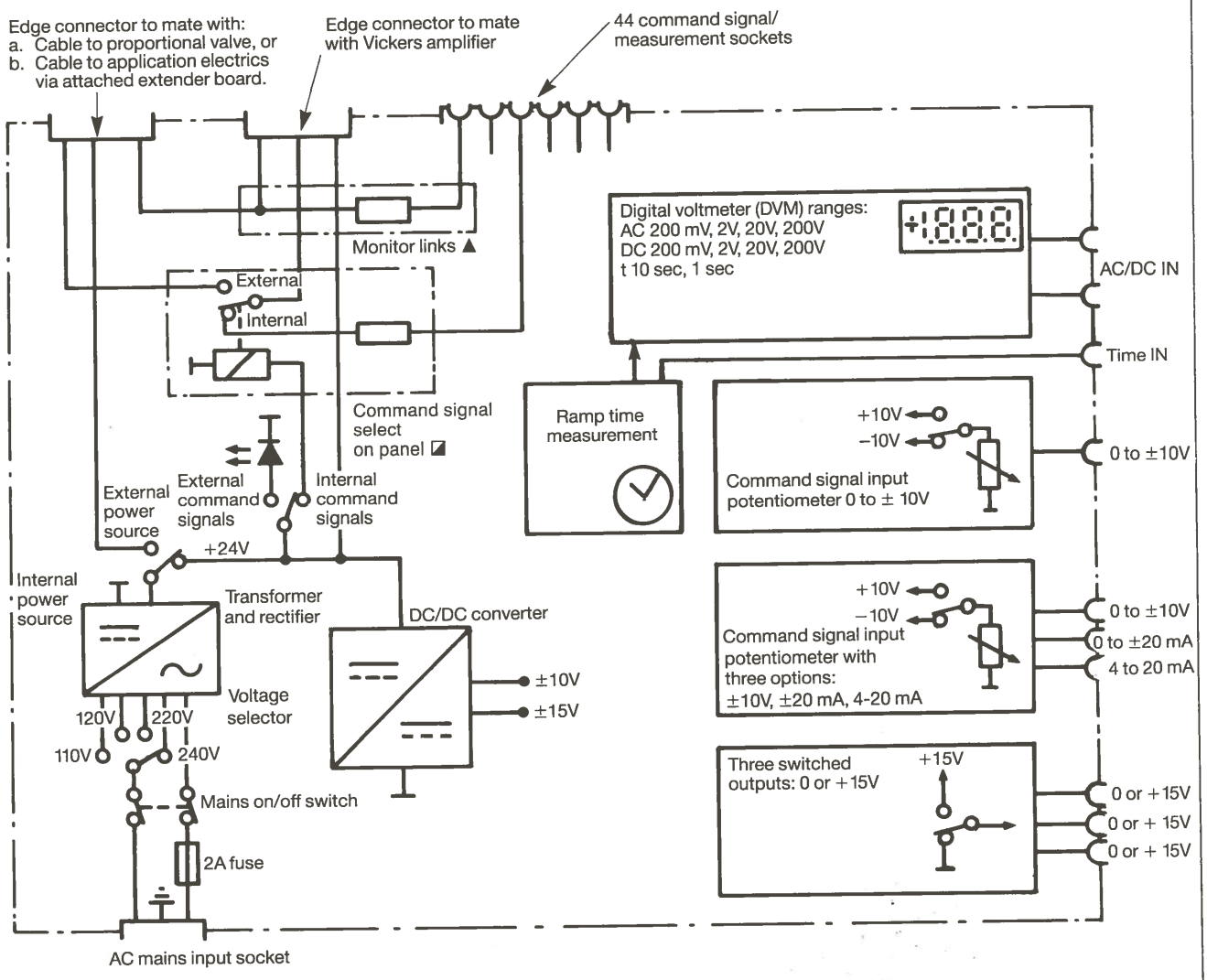
Note the LEDs that illuminate when the 24V and 15V outputs are live; shown in section 4 above.

# Portable test equipment for K*G4V, KF and KH series proportional valves and associated Vickers amplifiers

EHK-TEQ-700-A-20 series



## 1. Circuit and connections




◪ Certain pins of the same identity in the two edge connectors and the socket panel are linked internally as shown above. These pins are:
z4, 6, 8, 10, 16, 24
b4, 6, 8, 10, 12, 16, 18, 20, 24
d2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28

▲ Other pins of common identity but not listed above are connected as shown

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| Preventive measures | Solid contam. | Fluid degradation by - High temp. | Water | Air |
|---|---|---|---|---|
| **For storage barrels** | | | | |
| ☐ Store in cool, dry location. | | ● | ● | |
| ☐ Ensure that bungs or plugs fully seal-in the fluid. | ● | | ● | |
| ☐ Wipe away any dirt and moisture from around the bung or plug **before** loosening and emptying. | ● | | ● | |
| ☐ Use a portable filtration unit for emptying and re-filling. | ● | | ● | |
| **For storage tanks** | | | | |
| ☐ Install in cool, dry location. | | ● | ● | |
| ☐ Ensure that all covers and stop valves effectively seal-in the fluid. | ● | | ● | |
| ☐ Keep filling lines clean; cap ends when not in use. | ● | | ● | |
| ☐ Use a portable filtration unit for filling and emptying. | ● | | ● | |
| **For hydraulic systems** | | | | |
| ☐ Provide fluid filter(s) in location(s) that ensure the requisite protection. | ● | | | |
| ☐ The ideal steady-state flow conditions through an off-line filter makes this a"must" for most applications. | ● | | | |
| ☐ Whenever possible, use filters having element condition indicators. | ● | | | |
| ☐ Vented systems must be fitted with an air breather appropriate to the environment(s) in which the machine is to be operated and the requirements of the system. | ● | | ● | ● |
| ☐ Fit strainers to pump inlet lines if there is risk of gross contaminant (e.g. string, rag, screws etc.) entering the lines. | ● | | | |
| ☐ Prevent air entering the system, particularly through pump inlet lines. Ensure air-tight joints in any sub-atmospheric zone of pump inlet lines. Also ensure that those lines and all return and drain lines terminate below the minimum fluid level in the reservoir; pump inlet lines should be sufficiently below to prevent air entering through a vortex at low fluid levels. | | | | ● |
| ☐ Design for, and maintain, fluid temperatures at optimum levels for the application. Fit coolers if necessary. | | ● | | |
| ☐ Locate or screen hydraulic systems away from high temperature sources e.g. furnaces. | ● | ● | | |
| ☐ Assemble system in clean conditions and by using clean practices. | ● | | ● | |
| ☐ Pre-clean pipes and reservoir immediately before installation. Cap any ends that cannot immediately be connected to mating components e.g. between shifts. | ● | | ● | |
| ☐ Remove protective caps only just before connecting mating components. | ● | | ● | |
| ☐ Use a portable filtration unit to fill the reservoir system. | ● | | | |
| ☐ Flush new systems, and those that have undergone major repairs, before commissioning. Temporarily remove cylinders and semi-rotary motors and replace by bridging pipes. Servo valves and similar high precision units should also be replaced by bridging units for flushing operations. Ensure that cylinders and semi-rotary motors are clean internally before connecting to the system. | ● | | | |
| ☐ Ensure that air breathers and reservoir covers are at all times properly installed and secured tightly. | ● | | ● | |
| ☐ Stop any leakage of water into the system from coolers or other sources. Make a leak-tight repair. | | | ● | |
| ☐ By planned maintenance, ensure that fresh filter elements are fitted (or metallic elements cleaned when appropriate) when indicators or visual inspection shows this to be necessary. | ● | ● | ● | |
| ☐ Take fluid samples periodically and examine to determine whether effects of particle contaminant, heat, water and air indicate need for more control of those factors or the replacement of the fluid fill. | ● | ● | ● | ● |
| ☐ Whenever the reservoir is emptied, clean it out thoroughly and remove all residual contaminant. If necessary, restore protective paint or other finishes. On completion, cap all openings unless the system is to be refilled immediately in which case ensure that air breathers, covers etc., are replaced. | ● | | ● | |

**● Installation and commissioning (start-up) guidelines**

The proportional valves in this catalog can be mounted in any attitude but it may be necessary, in certain demanding applications, to ensure that the solenoids are kept full of hydraulic fluid. If this proves to be the case any accumulated air can be bled from the solenoid bleed screws. This task is easier if the valve has been mounted base downwards.

Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system has been commissioned (start-up completed). Further advice about this and other factors is contained in the relevant leaflets listed below. Note that the relevant leaflet is to be shipped with each product and be available separately on request.

| Product | Leaflet |
|---|---|
| EEA-PAM-5**-* amplifiers | ML-B-9046 |
| KDG4V-3/5 directional valves | ML-B-9018 |
| KFDG4V-3/5 directional valves | ML-B-9018 |
| KFDG5V - 5/7/8 directional valves | ML-B-9044 |
| KFTG4V - 3/5 throttle valves | ML-B-9018 |
| KHDG5V - 5/7/8 directional valves | ML-B-9044 |
| KSDG4V-3 directional valves | ML-B-9018 |
| KTG4V - 3/5 throttle valves | ML-B-9018 |

## Spare parts for proportional valves and electronics

Should any of these cataloged valves or electronics become in need of electronic or mechanical repair they should be returned to the nearest Vickers repair center (see "Repair and warranty" below). The products will be refurbished as necessary and re-tested to specification before return to you.

Less extensive repairs i.e. seal replacements and, for non-feedback KD and KT size-3 valves, solenoid coil replacement, can be carried out at your premises by you or by a Vickers service engineer. These spare parts are listed below:

**For KD/TG4V-3 valves**
Seal kit 992612
Solenoid coil 458533, for
K*G4V-3-**C***-*(-V)M-U-G models
Solenoid coil 458463, for
K*G4V-3-**C***-*(-V)M-U-H models

**For KD/TG4V-5 valves**
Seal kit 565110

**For KFD/TG4V-3 valves**
Seal kit 565108

**For KFD/TG4V-5 valves**
Seal kit 565110

**For KFDG5V-5 valves**
Seal kit 992612, for solenoid pilot valve
Seal kit 859316, for pilot reducer module
Seal kit 565143, for main-stage valve

**For KFDG5V-7 valves**
Seal kit 992612, for solenoid pilot valve
Seal kit 859316, for pilot reducer module
Seal kit 565144, for main-stage valve

**For KFDG5V-8 valves**
Seal kit 992612, for solenoid pilot valve
Seal kit 859316, for pilot reducer module
Seal kit 565145, for main-stage valve

**For KHDG5V-5 valves**
Seal kit 565142, for solenoid pilot valve
Seal kit 859316, for pilot reducer module
Seal kit 565143, for main-stage valve

**For KHDG5V-7 valves**
Seal kit 565142, for solenoid pilot valve
Seal kit 859316, for pilot reducer module
Seal kit 565144, for main-stage valve

**For KHDG5V-8 valves**
Seal kit 565142, for solenoid pilot valve
Seal kit 859316, for pilot reducer module
Seal kit 565145, for main-stage valve

**For KSDG4V-3 valves**
Seal kit 565142

**● Spare parts for other hydraulic products**

For these products only seal kits are available, as below.

| Product | Seal kit |
|---|---|
| DGAM-5 adapter | 858927 |
| DGMA-7-W shuttle adapter | 565489 |
| DGMA-8-W shuttle adapter | 565490 |
| KDGMA-3 parallel-flow-path module▲ | 639141 |
| KDGMA-5 parallel-flow-path module▲ | 565488 |
| KDGMH-3 hydrostat modules▲ | 639140 |
| KDGMH-5 hydrostat modules▲ | 639142 |
| KDGMH-7 hydrostat modules▲ | 639143 |
| KDGMH-8 hydrostat modules▲ | 639144 |

▲ Consult Vickers if seal kits are required for F3-prefix models.

## Repair and warranty

Units for factory repair, or to be returned under warranty, should be sent with a description of the fault to the Vickers or distributor location in your area.

[illegible] ENTERPRISES
[illegible] Panorama Center
Bldg [illegible]

# System calculations for valve selection

The "Rated flow" values for this range of proportional valves are determined with a loop pressure drop (e.g. P-A-B-T) of 10 bar (145 psi) when the valve is fully open. Consult the valve specification pages of this catalog for details of available spool configurations and performance data.
The rate of flow thru a proportional valve is dependent on spool position and valve pressure differential. This is similar to flow thru a needle valve. As with a needle valve, when a proportional valve is open the rate of flow will increase and, if the pressure differential across the valve is changed (such as load pressure changes) the flow will vary*. Because of this, "Rated flow" is an arbitrary rating dependent on the above parameters.
It is important to properly size a proportional valve to achieve good resolution. A common mistake in specifing proportional valves is selecting too high a rated flow. The results may be poor control of the actuator, particularly with respect to velocity and resolution. The ideal valve size usually is one that provides just enough maximum flow to achieve the required actuator velocity.
The following steps can be used to select the proper proportional valve size. This procedure applies to a conventional four-way valve with equal area piston driving a load in which velocity is the critical parameter**.

$A$ = Actuator piston area, $cm^2$ ($in^2$)
$F_M$ = Maximum force, N (lb), required
$F_D$ = Force, N (lb), required to accelerate and maintain velocity
$P_S$ = Supply pressure, bar (psi), less other system pressure drops
$P_L$ = Maximum pressure, bar (psi), required to drive or accelerate the actuator under dynamic conditions
$P_V$ = Allowable valve pressure drop, bar (psi)
$V$ = Desired actuator velocity, m/s (in/s)
$Q$ = Flow required to drive actuator at the desired velocity, l/min (USgpm)

**Step 1**
Determine the actuator area.

$$A\,(cm^2) = \frac{F_M\,(N)}{10 \times P_S\,(bar)}$$

$$\left[A\,(in^2) = \frac{F_M\,(lb)}{P_S\,(psi)}\right]$$

**Step 2**
Determine the flow required to drive the actuator at the desired velocity.

$$Q(l/min) = 6 \times A(cm^2) \times V(m/s)$$

$$\left[Q(USgpm) = \frac{A(in^2) \times V(in/s)}{3.85}\right]$$

**Step 3**
Determine the maximum load pressure drop under dynamic conditions.

$$P_L\,(bar) = \frac{F_D(N)}{10 \times A(cm^2)}$$

$$\left[P_L\,(psi) = \frac{F_D\,(lb)}{A\,(in^2)}\right]$$

**Step 4**
Determine the allowable valve pressure drop.

$$P_V\,(bar) = P_S\,(bar) - P_L\,(bar)$$

$$\left[P_V\,(psi) = P_S\,(psi) - P_L\,(psi)\right]$$

**Step 5**
Refer to the "Flow gain" curves for the valves and determine the most suitable valve spool based on flow (Q) and pressure drop ($P_V$).

**Step 6**
Check the "Power capacity envelope" curve to verify that the flow determined in step 2 (Q) at the valve pressure drop ($P_V$) falls to the left of the power curve.

**Example**
A hydraulic system consisting of a pressure compensated pump, proportional valve, and equal area cylinder must develop a maximum force of 3400 N (750 lb) and move a 200 N (50 lb) load at a velocity of 0.8 m/s (30 in/s). The force required to maintain this velocity is 1000 N (250 lb) and the pump's compensator is set at 60 bar (800 psi).

**Select actuator area (step 1)**

$$A = \frac{F_M}{10 \times P_S} = \frac{3400}{10 \times 60} = 5{,}7\ cm^2$$

$$\left[A = \frac{F_M}{P_S} = \frac{750}{800} = 0.94\ in^2\right]$$

**Determine valve load flow (step 2)**

$$Q = 6 \times A \times V = 6 \times 5{,}7 \times 0{,}8 = 27{,}4\ l/min$$

$$\left[Q = \frac{A \times V}{3.85} = \frac{0.94 \times 30}{3.85} = 7.3\ USgpm\right]$$

**Determine load pressure drop (step 3)**

$$P_L = \frac{F_D}{10 \times A} = \frac{1000}{10 \times 5{,}7} = 17{,}5\ bar$$

$$\left[P_L = \frac{F_D}{A} = \frac{250}{0.94} = 266\ psi\right]$$

**Determine allowable valve pressure drop (step 4)**

$$P_V = P_S - P_L = 60 - 17{,}5 = 42{,}5\ bar$$

$$\left[P_V = P_S - P_L = 800 - 266 = 534\ psi\right]$$

**Determine spool required (step 5)**
From calculations, load flow (Q) is 27,4 l/min (7.3 US gpm) and valve pressure drop ($P_v$) is 42,5 bar (534 psi). Reference to the KDG4V-3 "Flow gain" graphs (see "Contents" pages) show that the 20 N spool (meter-in and meter-out) is just too small. This is confirmed by the "Power capacity envelope" for the valve which shows that the absolute maximum flow through the valve with 42 bar (609 psi) loop $\Delta p$ is 22 l/min (5.81 US gpm). There are two possibilities for this application and the final decision must be based on the exact circuit requirements. If meter-out only control is acceptable then the KDG4V-3-2C28S can be used.
Alternatively, if the circuit requires meter-in and meter-out control, then the valve selected should be the larger KDG4V-5-*C30N.

* To eliminate the effects of load changes, a hydrostat module may be used; see "Hydrostat, ... " in "Contents" pages.
** For differential area cylinders, base the calculations on the maximum cylinder flow rate.